Vol. 22 SEPTEMBER, 1936 No. 9

International Journal of Orthodontia and Oral Surgery

Published by The C. V. Mosby Company, 3523-25 Pine Blvd., St. Louis, U. S. A.

International Journal of Orthodontia and Oral Surgery

CONTENTS FOR SEPTEMBER, 1936

Orthodontia

Department of Oral Surgery

Department of Orthodontic Abstracts and Reviews

Editorial

News and Notes

Vol. 22, No. 9, September, 1936. International Journal of Orthodontia and Oral Surgery is published by The C. V. Mosby Company, 3523 Pine Blvd., St. Louis, Mo. Subscription Price: United States, its Possessions, Pan-American Countries, $7.00; Canada, $7.50; Foreign, $8.50. Entered as Second-Class Matter at Post Office at St. Louis, Mo., Under Act of March 3, 1879.

International
Journal of Orthodontia
and Oral Surgery

VOL. 22 SEPTEMBER, 1936 No. 9

Orthodontia

PRESIDENT'S ADDRESS

AMERICAN SOCIETY OF ORTHODONTISTS

H. C. POLLOCK, D.D.S., ST. LOUIS, MO.

IT SEEMS fitting that we are gathered here today in the city of St. Louis for the thirty-fourth annual meeting of the American Society of Orthodontists; inasmuch as it was here in this city, just thirty-five years ago, that there assembled a small group of pioneers interested in a promising and highly fascinating infant science called orthodontia. Those who met here at that time, with such enthusiasm and abiding loyalty to this new department of health service, little realized that their small nucleus was destined to grow aggressively to be the largest society for the study of malocclusion in the world!

It is interesting to recall the personnel of the group which sponsored the organization at that time. Without doubt the inspiration was the late Edward H. Angle and Richard Summa, both of St. Louis, who, with the support of students and protégés, organized this Society. Those present were: Milton T. Watson of Detroit; Herbert Pullen of Buffalo; Frank Gough of New York; and H. E. Lindas, T. B. Mercer, and William Rafter. These men set for their goal to enhance the understanding and promote the study of malocclusion. Dr. Angle, at that time an international figure in orthodontia, became the first president, in which capacity he served for two years; he was then succeeded by the late Milton T. Watson. Since the organization was launched, more than half of these men have passed on; however, they and those who are living

Presented at the Thirty-Fourth Annual Meeting of the Society, in St. Louis, April 21-24, 1936.

left to posterity an important heritage which has proved itself during these passing years to be one of the most meritorious health services for children, and the most highly specialized department of dentistry.

Although not a founder, one of the most tireless and loyal of the Society's workers left this life during the past year, to the great sorrow of orthodontists everywhere; Dr. Albert H. Ketcham was a Rock of Gibraltar to this Society for many years, and his name has been identified with all progressive movements in orthodontic history.

REORGANIZATION PLAN OF THE AMERICAN SOCIETY OF ORTHODONTISTS

Now, in 1935 and 1936, another important epoch appears, marking the mileposts in the steady advance of the specialty; this is the proposed reorganization of the American Society of Orthodontists, as outlined at the meeting in New York by the Reorganization Committee in April, 1935.

To go back, in short, into the background of the reorganization plan: At the suggestion of Dr. Leuman Waugh, president of the Society in 1934 and 1935, a motion was adopted at the meeting at Oklahoma City in 1933 that the president be directed to appoint a committee to make a survey and to devise a plan for the reorganization of the American Society of Orthodontists in order that the Society could be placed on a more wieldy national or even, perhaps, international basis. This action was complied with, and an active committee was appointed, comprising representatives of all the various sectional orthodontic societies throughout the United States and Canada. After a tremendous amount of work, travel, correspondence, and many conferences on the part of the committee and Dr. Waugh, the plan was first presented to the American Society of Orthodontists in New York in April, 1935. After no small amount of parliamentary confusion on the various points of the plan, the Society took the following action: That the reorganization, as formally presented in New York, be accepted in principle and handed to the incoming Committee on Constitution and By-Laws to work into line and bring before the Society at its next regular meeting, to be read by title. The matter then, as directed, was turned over to the Committee on Constitution and By-Laws: Oren Oliver, chairman, Frank M. Casto, and C. C. Howard.

From several sources I have secured expert legal and parliamentary opinion upon the entire reorganization plan as it has progressed up to this time; to review these opinions and to analyze them would be entirely too time-consuming and tedious here. These opinions, however, might be summarized thus: It is contended, in one expert's opinion, that the American Society of Orthodontists in launching this comprehensive plan is dealing with an entire reorganization fundamental to the policy and purposes of the mother society, and that this cannot, under any circumstances, be approached as an amendment to the present constitution. A change in the name, fundamental purpose, modifications in the objects and business, affecting the rights of the individual members cannot be made without the consent of the state of Pennsylvania, under whose statutes the charter of the American Society of Orthodontists was granted and is now held.

Still another expert on parliamentary law tells us that our Society has a Constitution and By-Laws, or an organic law, in effect until we change it, whether by reorganizing or by amending. It is not dissolved first in order to reorganize. Reorganization is on the basis of the old organization and consists in amending from Article 1 to the end—whole or in part. He contends that we are changing very little, the name ceases to be "society" and becomes "association," otherwise the same. The object does not vary an iota, but we create divisions within America of our original constitution. The officers, committee, quorum, parliamentary authority, and amendments remain the same. The proposed changes are amendments, to be acted upon as such.

The problem is complex; the present organization is a matured, vigorous, and flourishing society; it has a record of accomplishment second to no other society in the field of orthodontia. It has a background of age and service that has made it a pattern which has been copied by several more recent specialties; and it enjoys a loyalty of purpose and *esprit de corps* akin to many fraternal organizations. This healthy condition, no doubt, is the result of tradition, good fellowship, community of purpose, and the tireless energy and devotion which were injected into the organization by its founders. The men who organized the American Society of Orthodontists were devoted to their purpose and were sincere in their efforts; and it is doubtful whether any health service ever has enjoyed the work of such an enthusiastic advance guard as has been responsible for this Society. Right at this time, then, during a period which is obviously one of transition, a time when the burden is being shifted to a younger generation, extreme caution and prudence should be exercised in order that the Society may abide by and emulate the wisdom contained in the immortal words, "United we stand—divided we fall!"

Subsequent to its organization and rather early in its career, the American Society of Orthodontists suffered an unfortunate division in membership as a result of misunderstanding, and this was responsible for the organization of an entirely independent society. This, of course, was unfortunate, and the incident brought about a division of effort within the ranks of the specialty; ever since that time orthodontia has been impeded by the division of interest of some of its most talented workers. It therefore seems entirely logical that any division of the organization again, by the withdrawal of any group from any section at this time, would be seriously detrimental to the best interests of the science. Obviously this would be greatly regretted in the future and would be reflected in a slowing down and loss of momentum in orthodontic advancement. The proposed reorganization of the American Society of Orthodontists at Oklahoma City was approached with great sincerity of purpose by Dr. Waugh and his coworkers, who spent much time and money on the plan. The Society owes these men no small debt of gratitude and appreciates the unselfish purpose and drive which were behind the effort to reorganize. There is an old epigram to the effect that "If you do not know which way to turn, wait!"

The foregoing explains the situation in which the American Society of Orthodontists unfortunately finds itself at this time in regard to the reor-

ganization. The whole reorganization plan has inadvertently and unintentionally become confused, the atmosphere so clouded with misunderstanding in various sections of the country that it seems both prudent and wise that the members be given more time to consider this very important subject, as there is much to be said for the reorganization idea and the plan should not be dropped, but should be developed by the proper committee and officers. It is thought by some that a special committee of the Society should be created, the legislative committee, or that a committee of the executive council, acting jointly with the legislative committee, should be authorized to proceed along lines designated by the Society. It would be tragic for orthodontia at this time if any of the sectional organizations should withdraw their support from the American Society of Orthodontists because the reorganization had been accomplished, and it would be equally unfortunate if any of the district organizations should withdraw because the reorganization plan is not adopted at this meeting. For these reasons I recommend at this time that the reorganization plan be continued, and be more carefully studied and better understood by more of the members. In the interest of orthodontia it is urged, therefore, that all sectional organizations stand by and remain as loyal as those intrepid and enthusiastic supporters of the organization who pioneered its course in the past. Time will solve the problem, as it does most problems of life. It will also offset the possibility of an improperly timed or unfortunate move, either to the left or to the right, at this time. Let us stand by and permit this matter to work itself out in a natural process of events and not do something which might work to the detriment of orthodontia as a whole.

Now, to another subject, the practice of our specialty during the last thirty years has been passing through a period of transition, during which its workers have been in quest of scientific improvement and dispatch of treatment. Spectacular advance has been the reward; and now that the work has emerged and established itself on a high plane of endeavor, another problem appears, plainly not so simple of solution as the methodical step-by-step advance in technic which has occurred in the past. Rapid change is taking place in the economic and social life of America, and it is now no longer doubted that all departments of practice must meet the health requirements of the new social order. This concept means that in the future health services are to be made available for all the people, as education has been made available to children of all the people. In this far-reaching movement, orthodontists realize that wheels must be put into motion within their organization as rapidly as possible, for the extension of service to reach much wider brackets of the people. In Dr. Waugh's presidential address before this organization just one year ago in New York, he emphasized the following point: "If we believe in the importance of orthodontic service as an essential health measure, and if the true professional concept be adhered to, then the duty to the children of the nation is plain, and utmost effort must be bent toward making all dental services available to all who need them."

It was pointed out that the benefits of orthodontia must not be confined to privileged children alone, and it was recommended that a socio-economic committee be appointed by the Executive Council of the American Society of

Orthodontists to study the problem, and to suggest ways and means to cooperate to attain this end. The foregoing recommendation exemplifies the highest traditions of all health service, upheld throughout the world, as set forth in the oath of Hippocrates. It emulates the tradition of all medical practice that the servant who administers to physical ills shall use his utmost skill with every patient, no matter what may be his biologic characteristics (as advocated by the Nazis) or be he to the "manner born."

The so-called mail-order problem is closely connected with this discussion. The Southwestern Society of Orthodontists, along with individual members of the American Society, during the past year registered vigorous protest to the editors and advertising departments of certain popular specialized professional periodicals, pointing out that the policies adopted by these journals in advertising laboratory-made appliances accompanied by diagnostic plans for the general practitioner operate not to the best interests of the public or of the profession, but serve to detract from the precision of orthodontic practice which the various orthodontic societies have endeavored to build up for many years. It has been pointed out that this is only a compromise service, usually of little, if any, value to the patient or the profession.

These protests to the journals, which have taken time as well as an infinite amount of correspondence, fortunately resulted in the adoption of a policy by the two leading popular journals to discontinue this type of advertising after the present contracts expire. The editors of these journals have been convinced that the service thus advertised is compromise treatment. Orthodontists everywhere are grateful to Dr. T. W. Sorrels of Oklahoma City and Dr. Paul Spencer of Waco, Texas, for their successful and vigorous educational campaign which resulted in eliminating the diagnostic advertising from the journals. Notwithstanding this good work, that very controversy has sharply revealed the fact that orthodontists as a group are and have been—unintentionally perhaps but, nevertheless—apathetic in that expert services in the past have not been made more available to a sufficient number of children who need the help. The principal contention of those who advocate the appliance—laboratory—treatment is that this method satisfies a voracious appetite for treatment on the part of the dental profession that the present orhodontic specialists do not supply, and that the now available treatment mechanism does not fulfill. It is contended, therefore, that compromise treatment is the only stop-gap and that, necessity being the mother of invention, laboratory treatment becomes the "invention."

For many years past, and at the present time, any licensed dentist may legally perform any dental operation or other dental procedure to which a patient or a guardian may submit, although it is well known that the course in dentistry does not equip the dentist to care for some of the more specialized needs of patients. In many instances the patient or his family have no way of knowing whether their dentist is really competent in a field requiring special training and experience. This is not peculiar to dentistry, because recently many medical organizations of the country, including hospital and university groups, have been cooperating to the end that public, hospitals, and professions may know who are qualified to be specialists. Orthodontia

has not been remiss; it has followed that development and now we have the American Board of Orthodontia, a national board which has the power of certification of specialists within its own field. It is interesting to note that in 1938 no physician will be listed as a specialist who does not possess a certificate from the national board in his particular branch of practice. Individual and state, also national, registers of qualified experts will be maintained. This creates an opportunity for the American Board of Orthodontia to be of real service in directing the specialist's qualifications to practice orthodontia. It is obvious that there is actually a shortage of properly trained experts to meet the needs of orthodontic treatment in this country. Although the problems of orthodontic training and education are still unsolved, and the type of training that is adequate is as yet a debatable question among specialists themselves; in the course of time the great universities will probably solve this to the satisfaction of every one.

Perhaps a step in the right direction to solve the treatment and economic problem is the plan of the Medical Service Bureau which is now being tried in the city of St. Louis. The plan requires that the physician or the dentist send his patient to the Bureau with an estimate and outline of the treatment. If agreeable, the Bureau accepts him and agrees to assist in making the proper arrangements. The Bureau is controlled by a Board—the Medical-Dental Service Bureau Board—number of members of the bureau being based upon the membership of the various societies. The Medical Society, having a thousand members, has ten representatives on the Board. The Bureau in St. Louis is conducted by a representative board appointed by the medical society and the dental society.

Still other important and significant movements are under way, all pointing to the same destination. Recently an ambitious program has been launched by organized medicine in the state of Missouri, as outlined in the annual report of the Missouri State Economic Committee. This state-wide movement backed by organized medicine proposes to make medicine into an incorporated unit fundamentally beneficial to public health and to place the best medical service within the reach of all, regardless of financial status. This is the latest answer of organized medicine, in this state at least, to the immediate problem of health for all the people.

As a further emphasis to the increasing importance of the orthodontic problem, the editor of a popular journal presented a rather comprehensive, if unwieldy, plan to an informal committee of orthodontists, at the February meeting of the Chicago Dental Society. Obviously the purpose was to extend diagnostic and treatment aid by the orthodontist to the general practitioner who includes orthodontia in his practice. The plan was offered as a substitute to the general practitioner who had heretofore been depending upon the laboratory service already referred to. The committee, however, apparently believed this particular plan unworkable. The gesture further emphasizes the fact that the problem is here, and we must do something to assist in its proper and logical solution if we are to expect the ridiculous laboratory diagnostic aid service to be relegated to the scrap heap.

The propaganda particularly active in the East which advocates the extraction of all four first molars of children for the correction of malocclusion should not be ignored, but should be met by the opposition it deserves from orthodontists, because this propaganda is harmful to public welfare and to professional progress. This treatment appeals to those who do not understand the biologic aspect of orthodontia and who do not realize that the cure is worse than the disease. Something should be done about this.

In accordance with the views presented last year and formally accepted by this Society, a committee has been appointed whose purpose it shall be to study this problem, and bring in a report with recommendations at the next annual meeting of the Society as to ways and means of extending competent orthodontic service to more people in conformity with the trend of the times in all health service. The committee: T. W. Sorrels, Chairman; Harry Allshouse, and Russell Irish.

In conclusion, I extend thanks and sincere appreciation for the loyal cooperation which has so willingly been given me during this administration. I wish also to thank all the local committees for their fine work. I am sure that I am voicing their sentiments in saying that we hope you will have a profitable meeting and a very delightful and happy time in this city, in which thirty-five years ago the American Society of Orthodontists was started.

GROWTH

Ossification of the Bone Centers of the Hand as Correlated With General Growth Stages

Clinton C. Howard, D.D.S., Atlanta, Ga.

THE growth of living matter, though tangible in a degree, being capable of measurement to a limited extent, has not been made completely understandable as far as its fundamental nature is concerned. Growth being a co-partner with development places it among the *most constant* of all of life's processes.

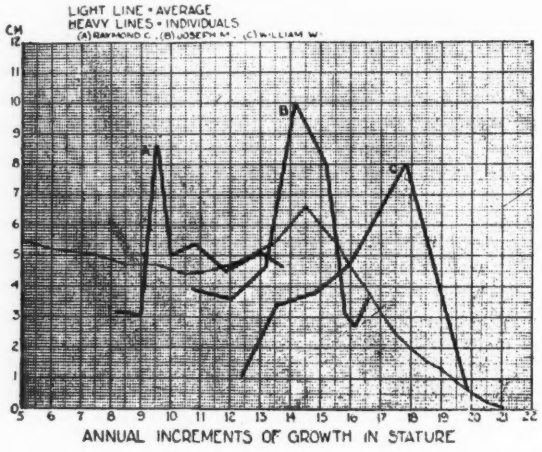

Fig. 1.

The problem of understanding growth in a definite sense becomes quite muddled when we consider the interaction of inherited tendencies with environmental influences. The varying degrees of susceptibilities peculiar to each organism of the same species complicate any definite solution of an applied rule. All the more is this true because of the heterogeneous mating of man.

Observe a family of say six children, all of the same sex, of the same parents, brought up under the same environment, and compare the differences of their growth. Each of the six will show variations in skeletal measurements. They reach their matured stature in varying degrees of growth rate. This demonstrates one of the accepted facts pertaining to growth phenomena, which may be expressed as the "law of variation in living material." This law makes untenable all mathematical theories as applied to the growth of the individual.

Read before the Thirty-Fourth Annual Meeting of the American Society of Orthodontists, April, 1936, St. Louis, Mo.

Davenport in 1931 showed the unreliability of average-growth-charts as a guide to the management of orthodontic growth problems. (Fig. 1.) He pointed out that an average-growth-curve obtained from mass measurements was tremendously different from the growth curve of any one of the several thousand who contributed to the average-curve.[1] An expectancy arrived at from mass statistics is, therefore, valuable in degree only. So again we are confronted with the one constant law of growth, the invariance of variability.

GROWTH CYCLES

The assumption that growth is a smoothly progressive process is not valid in the light of present information. To the contrary, acceleration and inhibition (or slowing down) constitute Nature's scheme of growth. Robertson and others,[2, 3] working independently, agreed that animal growth was intermittent in its progress and was divided into three stages which might be termed "spurt stages." "The first growth cycle in man begins with fertilization and ends at about the first year of postnatal life. The second centers about the sixth or seventh year as to its peak, and the third is the adolescent spurt." My own observation is in agreement with the last two stages. The first, or fetal stage, I accept as a matter of embryologic knowledge.

TABLE I

SHOWING CORRELATION OF SECOND AND THIRD GROWTH SPURTS WITH THE ADVENT OF OSSIFICATION AND GROWTH OF THE BONE CENTERS OF THE HAND

First Growth Spurt		The period of fetal life represents the greatest growth and developmental spurt.
Second Growth Spurt	1 2 3 4 5 6 7	At one year ossification appears in the os magnum, the unciform and the epiphysis of the radius. Between two and three years ossification appears in the cuneiform and epiphyses of the metacarpals and phalanges. From three to five years ossification appears in the trapezoid, trapezium, semilunar and the epiphysis of the ulna. Between six and seven years ossification appears in the scaphoid.
Inhibition Stage	8 9 10 11	Ossification of new bone centers fails to appear during this stage.
Third Growth Spurt	12 13 14 15 16	Pubescent Spurt Rapid growth of all bones. Ossification of pisiform and sesamoid at eleven for girls and twelve to thirteen for boys.
Maturity and Inhibition Stage	17 18 19 20 21	The union of the epiphyses begins at about fifteen years for girls and about seventeen for boys.
	AGE IN YEARS	(C. C. Howard—1936.)

The second spurt ending at the age of about seven years is significant in its correlation with the osseous advent and growth of the bone centers of the hand.[4] At birth calcification is noted by x-ray examination in the meta-

carpals and phalanges only. At about six months two carpals and one epiphysis make their appearance under x-ray examination. Also during this second "growth spurt" twenty-one epiphyses appear in addition to all carpal bones with the exception of the pisiform.

To add to the significance of this correlation, the advent of ossification in no other bone of the hand takes place between the ages of seven and eleven years, or during the first "inhibitory stage."[5] Between eleven and fourteen years, which is the most spectacular postnatal growth spurt, there appears the pisiform carpal bone and the sesamoid, and in our studies of more than 4,000 hand

Fig. 2.

Fig. 3.

pictures we learned that during this pubescent stage of rapid growth there is a tremendous increase in size of all bone centers of the hand. During the second inhibitory stage, which is from sixteen to eighteen years in the female, and from eighteen to twenty-one years in the male, the union of epiphyses with their parent bones takes place.

Attention is directed to Table I, which is a condensed demonstration of the above described correlation.

THE OSSIFICATION OF HAND BONES AS AN AID IN INTERPRETING GROWTH VARIATIONS

In the study of hand bones, the epiphyses and distal ends of the ulna and radius are included in x-ray examinations. Properly these anatomical

points are not a part of the hand bone group. They offer, however, important information concerning the integrity of ossification and are included as a part of hand bone study.

At birth the normal infant's hand will show twenty-one long bones including the distal ends of the ulna and radius. From about six months after

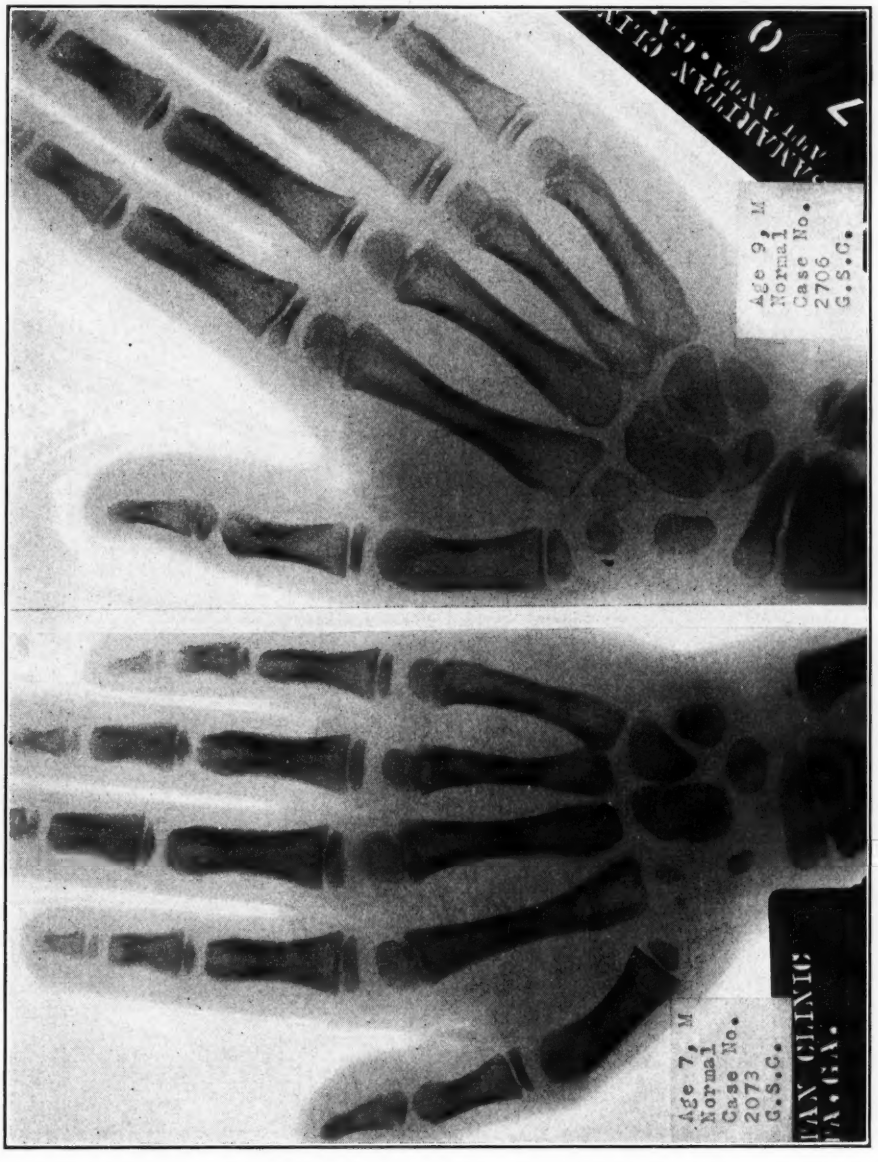

Fig. 5.

Fig. 4.

birth to about seven years, twenty-eight centers of ossification make their appearance under x-ray examination. The advent of these twenty-eight ossification centers occurs in fairly uniform order, of course allowing for normal variation.

Figs. 2, 3, and 4 demonstrate, by x-ray findings, the correlation of the physiologic ossification of twenty-eight bone centers with the second "growth spurt." Figs. 5 and 6 demonstrate the *absence* of new ossification during the

first inhibitory growth stage. Fig. 7 shows not only the appearance of two new centers of ossification, namely the pisiform carpal bone and the sesamoid, but also a marked increase in growth of all centers. Compare Fig. 6 which

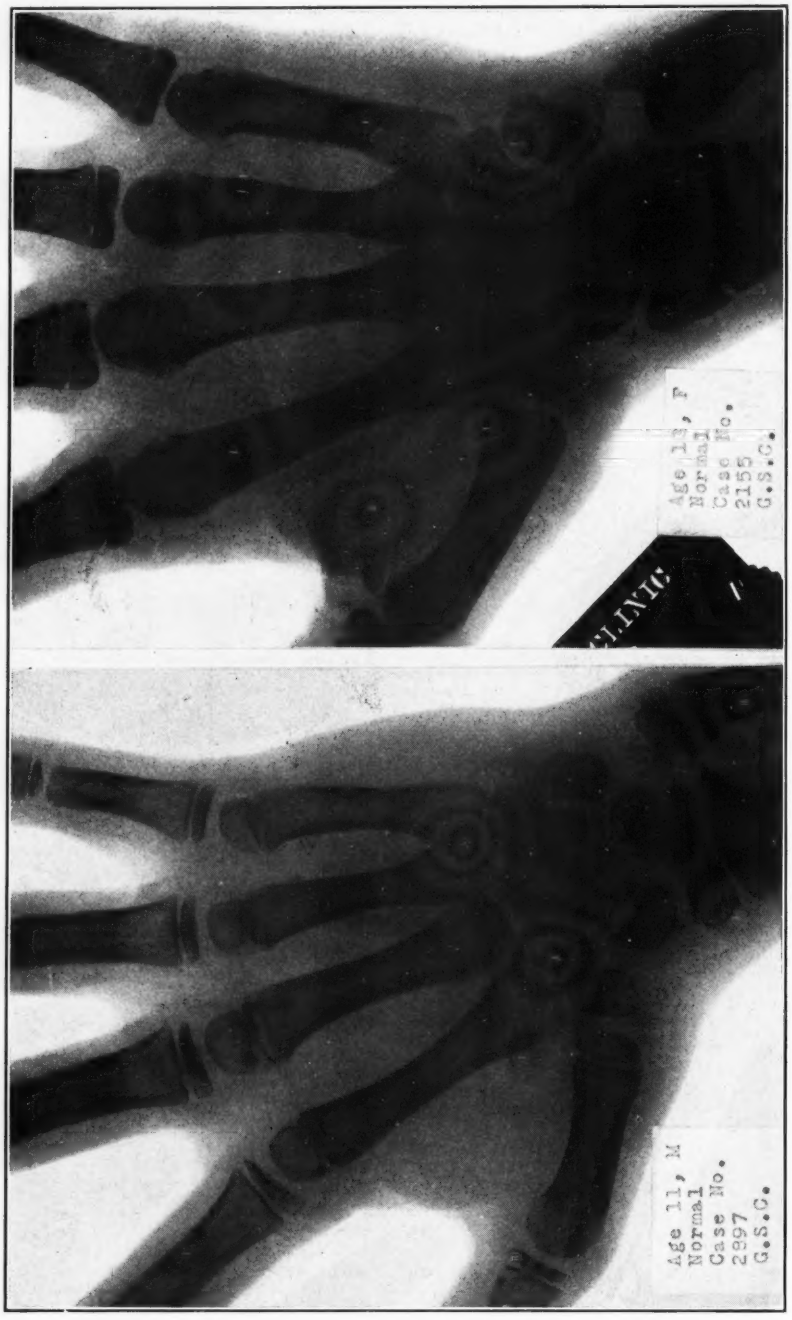

Fig. 7.

Fig. 6.

represents the ossification status at the end of the first *inhibitory growth stage* with Fig. 7 which represents ossification increase during the *pubescent* or *third growth spurt*. This concludes the *fifty-one* centers offered by the hand for study.

Fig. 8 illustrates in chronologic terms the expected physiologic growth spurts and the physiologic inhibitory growth stages. This scheme was constructed by Dr. George Moore, Ann Arbor.

SIGNIFICANCE OF CORRELATION

This brings us to the point of formulating a concept based upon fundamentals of known value. Each case presenting a *growth problem demands an individual study.* Should a case be presented with a retardation in the growth of the dental arches and jaws during the second stage of "growth spurt," i.e., from one to seven years, I would elect first to study the growth of the individual rather than employ mechanical means for its correction. In other words, it is important to know something of the manifestations of the material with which we are dealing. Some of these cases will present an inhibitory stage of growth during an expected "growth spurt" stage. Such slowing down may be due to environmental influences such as ill health, food, socio-economic influences, etc. It could result from the inactivity of the growth hormone.

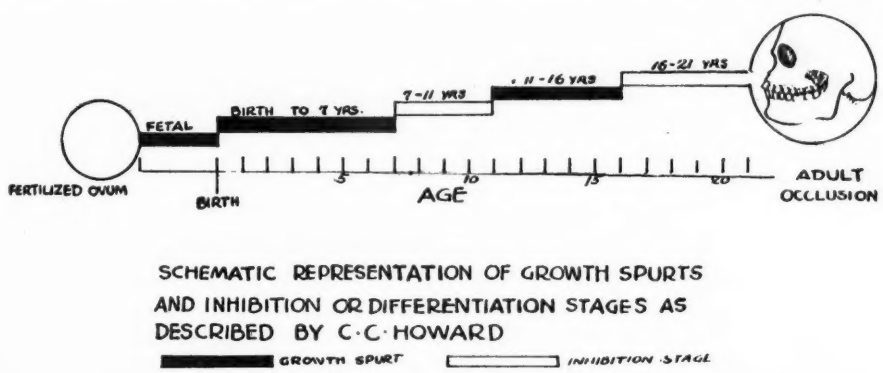

Fig. 8.

On the other hand, a *temporary retardation* in the progress of growth during this period may be but an expression of the normal physiologic scheme of growth. As stated before, the speed of growth is not smoothly progressive.

A case of retardation of arch and jaw growth presenting itself during the first "inhibitory stage," i.e., from seven to eleven years, does not justify orthodontic assistance for two reasons. First, because of the fact that growth seems to be in a state of physiologic quiescence during this period, an attempt to force growth through synthetic stimulation would not be backed by *natural growth trends.* Second, it is a known fact that during this same "inhibitory stage" there is a rapid resorption of the roots of the deciduous teeth. This would preclude the possibility of stimulating growth in the bony structure in which they are imbedded. In my own experience an attempt to cause the dental arches to take on larger dimensions during this period has almost invariably been followed by a second stage of orthodontic stimulation after the eruption of the permanent premolars and cuspids, and it is at this age when the third "growth spurt" begins. In short, orthodontic assistance, in an attempt to stimulate growth during the first "inhibitory stage," is contraindicated by the facts just quoted.

Age expressed in chronologic figures is of little value as compared to the physiologic status of a growth problem. The time element consumed in the wearing of orthodontic appliances could be materially reduced if the growth status of the individual was studied previous to the application of mechanical stimulation, as well as during the period of treatment.

That I may not be misunderstood, a correction of mal-locking individual teeth which are causing an interference with function should be attempted at any stage. Such assistance has to do with local areas and must not be construed as an attempt to alter bone growth.

REFERENCES

1. Davenport, C. B.: Individual vs. Mass Studies in Child Growth, Am. Phil. Soc. **70**: 381, 1931.
2. Abt's Pediatrics, 1922.
3. Aldrich, C. A.: Growth and Development, J. Pediatrics **2**: 80, 1933.
4. Cohn, Isidore: Normal Bones and Joints, Paul B. Hoeber, Inc., New York.
5. Howard, C. C.: The Physiologic Progress of Bone Centers, etc., INT. J. ORTH. **12**: 948, 1928.

1105 DOCTORS BUILDING

ORTHODONTICS IN THE FIELD OF MAXILLOFACIAL SURGERY

LEIGH C. FAIRBANK,* D.D.S., F.I.C.D., WASHINGTON, D. C.

A REVIEW of the literature covering the last twenty years reveals some very interesting facts concerning maxillofacial surgery. At the beginning of this period we find a united effort on the part of all branches of medicine and surgery to alleviate the painful and disabling wounds of war. At no other time in all medical history has there ever been such an inspiring picture of accomplishment. Dentistry stepped into its place and assumed a rôle which it carried out with lasting credit. Our own country established a policy in regard to maxillofacial surgery which was sound, and the record stands as one of the most striking aspects in all the annals of surgery.

Success in this field disclosed a need for the grouping of several specialties of dentistry in its accomplishment. It was founded upon a conviction that basic requirements in treatment and the recognition of a sane and honest cooperation among the plastic and oral surgeons, the prosthodontists, and the orthodontists were necessary in the effort to restore the mutilated faces to a place of comfort and happiness in society. This was the most outstanding opportunity for the plastic and oral surgeons; and, when they worked side by side with prominent dental specialists, function was restored, faces were rebuilt, and success in a large measure proved the soundness of the established policy. It became an interdependent group or tripod of specialists working heart and soul for perfect results. This cooperation was essential, for all the history concerning the surgical repair of the dental structures by surgeons shows a decided need for this grouping and liaison with the dental profession to assure the restoration of function. The ultimate of all maxillofacial work should be the restoration of perfect function within and appearances without, and this ultimate is seldom achieved without the dominating influence of dental specialists.

One notes that there has been an astounding lack in the further development of this interdependent relation in the years following the war. Very largely in the hands of oral surgeons, it has been dominated by a surgical concept, except to invite the aid of dentists to check the reestablishment of original occlusion or the laboratory technicians to construct splints. There has been a world-wide trend toward open operation and direct fixation; there have been futile efforts by surgeons to apply orthopedic measures without regard or understanding of the special dental orthopedic measures developed in this field with its understanding of occlusion and function and that it is applicable in the movement of fragments en masse just as readily as it is for tooth movement. The growing frequency with which papers and case reports are presented concerning maxillofacial injuries by orthodontists before the various dental societies in many sec-

Presented to the American Board of Orthodontia, and released by the Board for presentation before the American Society of Orthodontists, St. Louis, April 21, 1936.

*Lieutenant Colonel, Dental Corps, United States Army.

tions of the country indicates a realization of the value of orthodontics in this field and that it is just as essential in maxillary injuries as orthopedics in the field of general bone surgery.

Dentistry faces a challenge today in the treatment of maxillary fractures, and orthodontia must assume its place for the benefit of the increasing number of patients requiring care. We are living in a period when traffic and industrial accidents and sports injuries in the daily lives of our millions have become of grave national concern. These conditions require changes in many aspects of general surgical developments, just as the newer methods of warfare created newer surgical demands twenty years ago. Newer concepts of physiologic and pathologic changes in treatment as correlated by the orthodontists give a vastly different picture to the aspects of surgical treatment of maxillary injuries. We must step to the fore in this problem as it affects dentistry—our love for our profession, our devotion to our specialty, and our great professional responsibility demand it.

There are many obvious conditions associated with maxillary injuries which bear upon the considerations of treatment. The oral surgeon is concerned with the restoration of form as influencing facial form in the plastic operations and with function, particularly as it involves the temporomandibular articulation. The orthodontist assumes a far greater and more important responsibility in the reestablishment of original occlusion or, in cases with loss of large fragments, a functional occlusion. With them the prosthodontist is an essential aid, for in many cases splints are necessary, and it must be their combined considerations which develop the logical and sound methods of treatment. They must consider the injuries to the bony processes, laceration of the soft tissues, disturbed occlusion, and the several other factors present, varying in degree but influencing treatment. Not only the type of fracture, its location, and the complications encountered but also the muscles involved and their relation to the fragments are all conditions influencing treatment. These elements often combine to bring about displacement, predispose to aggravating septic conditions, and delay the healing processes. Treatment may be delayed indefinitely because of fractures of the skull, concussion, or by serious general injuries and infections.

The normal influences of muscle pull are altered, and the deviations in direction of these forces, due to the angle and location of fractures, are variable factors in each case. We visualize the various muscles in this area as having a normal pull; we can further visualize these forces as exerting a displacing effect upon the fragments. In this manner the elevator and depressor muscles bring about much of the displacement noted upon examination. The muscles exert, however, important stresses in other directions, and they become very marked when the continuity of the mandible is broken. Georges Villian,[1] prominent French dental surgeon, made a very comprehensive study of the muscles in relation to fractures of the mandible. By dividing the mandible into sections to which the depressor and elevator muscles are attached, he related them to the fractures and developed his classification.[2] According to Pickerill, the facial muscles of expression have an inward molding effect upon the fragments of both jaws and tend by their use to narrow and compress the dental

arches in a backward direction. The buccinator, exerting an influence, either directly or indirectly, upon the maxilla and the mandible, changes the position of the maxilla, displacing the segments downward and backward.[3] He also states that abnormally developed muscles, particularly the pterygoids, are often unrecognized in maxillary fractures and their action overcomes the pull of the masseter and temporal muscles; or, if the fracture is just anterior to the attachment of the superior constrictor,[4] and the patient is continually swallowing, the posterior fragment will be tilted inward. Bodine sought to develop a useful classification in which he related the teeth to the fragments, and his concept is of great value in outlining a plan of treatment.[4]

Combine with these considerations two other factors which are invariably vital considerations: the missile, with all the complicating elements associated therewith, and the direction of this foreign body. These are considerations in gunshot wounds; in other types of injuries the direction of the forces or blow and the tissue complications are equally important. They influence our approach to treatment and often determine the methods of treatment in a comprehensive way. They are always major factors, factors which it would be well for the oral surgeon and the orthodontist to consider together, with a determination to pool all their knowledge and skill to the end that a more beneficial service may be rendered.

It is obvious that in many cases of maxillofacial injuries the inherent character of the tissues involved carries on their recuperative processes with amazing rapidity, and little thought is given to the normal reparative factors at work. Orthodontists have devoted years to a study of the character of bone. They daily accomplish changes in the supporting structures of the teeth, and this splendid background fills a great need in maxillofacial surgery. Greater consideration has been given the physiology, pathology, histology, and biology of these tissues. The applied therapy of orthodontic treatment stimulates the activity of the osteoblasts and osteoclasts in tooth movement, and this therapy is applicable for the movement of fragments en masse. This aspect will appear with new meaning to the oral surgeons, perhaps, regarding regional structures of the face, particularly when correlation is made regarding the effect of stimuli to influence reparative processes.

The process of tissue repair is most complex, and back of all our knowledge lie some very interesting aspects regarding the repair of bone. In a study of the biology of bone it has been established that bone and cartilage are derivatives by adaptation from connective tissue. Bone will revert to connective tissue, or cartilage be transformed directly into bone. In fact, tissue of the connective tissue group undergoes ready and frequent transformations. One must bear in mind the connective tissue origin of bone and that it dominates all the problems of its growth, regeneration, and repair. Bone differs from all other connective tissues in that repair takes place by the formation of a cementing substance which exactly reproduces its own structure.[5] Regardless of their type, the cementing substance is fibrous tissue in the repair of other tissues. Under the functional adaptation, undifferentiated connective tissue may become special-

ized in some degree and assume various structural types. It may become loose connective tissue or it may become a fibrous tissue with solid bands—powerful agents of resistance.

The normal reparative process in an ordinary simple aseptic fracture is the result of a small number of simple agencies.[6]

I. Post-traumatic hemorrhage between the fragments and the periosteum.
II. Organization of the clot and rarefaction of the ends of the fragments.
III. Formation of new bone in the clot organized in the periosteum.
IV. Union of the fragments by callus.

The hemorrhage is followed by the coagulation and formation of the blood clot. The congestion in the bone produces resorption with the liberation of calcium salts. Under normal conditions it follows that the callus will form as an inevitable phenomenon. When we relate the immediate consequences resulting from the traumatism present in maxillary fractures—the hemorrhage, break in the continuity of bone, the paralytic vasodilatation, and subsequent repair—with the biologic events incident to orthodontic treatment, we view with greater interest the rôle of orthopedic measures in the treatment of maxillary injuries and its finer possibilities in reestablishing original occlusion.

Important factors play their part in the resultant bony formation and the condition of repair obtained. The conditions surrounding maxillary injuries often predispose to complications. Among these factors might be mentioned infection, affected blood supply to the parts, comminuted tissue, faulty treatment, and the general health of the patient. Septic conditions are more common in maxillary fractures than in any other bones of the body. Over 90 per cent of the fractures of the mandible are compound and without proper care develop abscesses and necrotic conditions which prolong treatment and greatly alter the mode of treatment. A diminished blood supply, caused by injury to the blood vessels, inhibits the activity of the osteoblasts and osteoclasts, and bone regeneration does not take place. A damaged blood supply leads to pseudoarthrosis.

Faulty treatment, the general health of the patient, nutrition, etc., greatly influence the processes of repair. Insufficient reduction affects materially the reparative processes. In cases with great traumatism and considerable displacement, a quantity of serum between the fragments prevents consolidation. The interposition of muscle tissue prevents union. It also appears that the processes of ossification and fibrosis are antagonistic. The fibrosis being more rapid than ossification, the connective tissue cannot be utilized for ossification. The interposition of the reparative products of surrounding connective tissue, of the connective tissue itself, or even periosteum, constitutes the factors preventing union.

Comminuted bone is one of the most discouraging factors in maxillary injuries. So often complicated with injuries to the soft tissues and the blood supply, it frequently calls for the closest cooperation among the specialists engaged in treatment. As a general rule, the comminuted fragments should be retained and only those which are near the surface removed. Nature will exfoliate the smaller pieces but the larger portions really become centers of

ossification when the process of regeneration begins. Such fractures, even when compound, unite with surprising firmness and rapidity under proper treatment. The remarkable regenerative power of bone is splendidly portrayed by Kazanjian in the reports of his work during the war.[7, 8]

These conditions bring to us very clearly the need for the close association of a maxillofacial group and a quickening regard for the opinions of the whole group and the importance of the orthodontic viewpoint. Unquestionably, the surgeon feels that in many of these cases the only satisfactory result will be obtained by surgical treatment, but there should be a very careful survey of every aspect before any plan for treatment is decided upon. There are many old and neglected cases and those in which the health of the patient will not permit surgical interference requiring a careful analysis before determining treatment. It has been claimed by some that gradual reduction or orthodontic treatment is particularly limited to these cases, but such a statement is made by those who are not aware of the broad application of orthodontics possible in this field.

Our admiration for the splendid work accomplished by orthodontists in the field of maxillofacial surgery in the past grows with our increased understanding of their trying problems and the skillful solution of the aspects so evident in their efforts to reestablish a functional occlusion. The work of Hume and Eby and of many others gives us a vast series of interesting pictures as to the thoroughness, care, and broad concept which are so very necessary in this work.[9] The more I study their work, the more I investigate the background of their concept; and the more I observe the present trend, the more convincing become the logical conclusions and sound convictions of their plans in giving orthodontics a definite place in the field of maxillofacial surgery.[10] They have given us much to shoot at—to encourage and inspire us toward further effort—and all of us should understand in a clear manner the soundness of their opinions and influence future developments toward the ultimate consummation of their concept.

The fracture surgeon dreads the treatment of maxillary fractures more than all others, and the despairing results easily afford the answer. Oral and plastic surgeons have not fully grasped the importance of liaison with the orthodontist and approach this work with a surgical concept backed up by the prosthodontist as their only aide. Many cases are restored to original occlusion at their hands, and I would not deny them the glory of real accomplishment. I do emphatically deny the need for so large a percentage of open operations and direct wiring, the claims that 95 per cent of all maxillary fractures can be successfully treated by intermaxillary wiring, or that a head harness, closely related to a baseball mask, is the best and only anchorage available by which one can use elastic traction to establish arch form, for reduction of segments, and secure original occlusion. Nor do I further accept the idea of cast splints, bulky in design, decorated with nuts and bolts, as being universally necessary or even suitable in a field in which hygiene is of paramount importance. It is encouraging to find that Dunning has frowned upon the open operation in this country but disappointing to learn that he has not discarded the bulky and rigid fixation of the cumbersome intermaxillary splints.[11] An orthopedic

influence is not altogether lacking in the maxillofacial work done at the Cook County Hospital, as reported by Schaeffer and Skinner, but faulty anchorage and antiquated methods cannot be accepted as modern practice.[12] Dorrance and Loudenslager present the most advanced and acceptable methods from the standpoint of the prosthodontist.[13] Their splints are less bulky and of the gallery splint type, but the extreme immobility secured fails to recognize the fact that it is possible and desirable to obtain reduction, fixation, and union of the fragments without great force and complete immobilization. Their methods might be considered the most favorable today for those cases with great loss of bone requiring fixation and immobilization prior to bone graft operations. Krohn and a host of surgeons in Europe and America have sought to apply traction for reduction. Their chief concern has been to avoid ankylosis of the temporomandibular joint. Their results have proved that it is possible to reduce maxillary fractures without force and complete immobilization of the joints can be avoided.[14] It is stimulating to find a surgeon who recognizes the outstanding possibilities of orthodontic aid in this field. Moorehead[15] of Chicago expresses his belief in its values: "The principles and methods of modern orthodontia supply the means of managing fractures of the jaws, regardless of the type or extent of injury. The more difficult, the more convincing and satisfactory the method becomes." Davis, Ivy, Kazanjian, Blair, and others have recognized the benefits derived by association with the orthodontist in the treatment of various other maxillofacial conditions, and the results obtained indicate the great advantage, as either a preoperative or a postoperative procedure.

In the treatment of injuries to the maxillae and associated bones of the face, many complications arise which have long made these cases very troublesome to the oral surgeons. The superior maxilla is usually fractured either vertically or horizontally and frequently involves other structures, such as the zygoma, malar, and nasal bones, with tearing of the soft tissues. There may also be a crushing of these bones and serious sinus infections. Roentgenograms seldom disclose the lines of fracture, and plans for reduction and fixation require a close study of the conditions with a dominating dental influence for the ultimate restoration of original occlusion. There are grave dangers involved in open operations, and very little is to be gained by such methods. Splints, headcaps, and extraoral anchorage and extension are essential aids in treatment. In published case reports and cases coming under my personal observation, in which oral surgeons have tried to apply orthodontic principles in the manner in which they conceive them, it appears that their results clearly indicate a great need for closer liaison with the orthodontists. But few of them have grasped the significance of the various types of anchorage and the indications for their use as adopted by many oral surgeons over twenty years ago.[16]

Fixation and control of sepsis are the two most essential elements common in all fracture treatment. Over 2,000 years ago, Hippocrates used gold wire for fixation in fractures of the mandible, but not until the advent of Wilhelm's *Praxeos Totius Medicinae* in 1275 do we find any reference to the advantages of stabilizing the approximate wired fragments in the mandible to the teeth in the maxillary arch. The treatment of maxillary fractures passed through an interesting series of evolutionary stages, but nothing basic was developed for

stable fixation until Dr. Angle extended his epochal development of orthodontia into this field.[17] This important step was not the only significant orthodontic contribution to this field of surgical treatment. The very fact that the orthodontist was daily concerned in producing changes in the osseous structure of the maxillae gave added importance to orthodontia as a related specialty in maxillofacial surgery, and upon this scientific basis its importance was fully recognized during the World War. Basic orthodontic principles of anchorage, retention, and the application of mild but stimulating force, the structural change in bony processes, and the dynamics of orthodontic treatment parallel the fundamentals of the orthopedic concept in general bone surgery. They are developments of established value in the dental field, for the dental structures, and best controlled by those experienced in their application. While orthodontic measures are of inestimable value in the early treatment of many maxillary fractures, in unreduced fractures with bony union where the gradual reduction of fragments is concerned, the treatment draws still closer into the orthodontic realm. As has been stated, displacement is due to a violent force from without and muscle pull from within. Appliances designed in accordance with the principles with which we are all familiar, giving due regard for the movement desired, constructed of slightly heavier wire and using spring force or elastic traction to overcome displacement will establish original occlusion or arch form with less discomfort to the patient and without complications. As soon as the displacement has been overcome, fixation can be secured by means of a variety of attachments, such as the bracket band, McCoy open tube, Ketcham hooks, etc. This fixation eliminates rigid intermaxillary attachments, permits free movement of the mandible, promotes a better state of oral hygiene, stimulates bone repair, and affords the patient a far greater comfort during the period required for bony union.

Intermaxillary wiring is the most universal method used for reduction and fixation. A careful testing of the occlusion after bony union has occurred frequently discloses that original occlusion has not been maintained. The mouth is continually in an unhealthy state because this method does not permit thorough cleanliness and predisposes to septic conditions. Furthermore, with the rigid approximation of the arches, the elevator muscles are inactive and the depressor muscles are under tension. This tends to displace the fragments sufficiently to disturb the occlusion, and bony union is secured with the segments in malposition. Regeneration is not so rapid when this method is used, and the added discomfort to the patient is a factor of increasing concern during the weeks of treatment. Intermaxillary wiring is desirable in many cases during the first two weeks, but after this period, heavy labial and lingual arches, soldered to molar and canine bands, become the most comfortable and efficient method of fixation.

Wilhelm Suersen adopted a method for the gradual reduction of old unreduced fractures with fibrous union during the Franco-Prussian War in 1870, and his methods are in use in Russia even today.[18] Suersen constructed vulcanite splints with a section for each segment which were thickened at the approximate ends. By forcing a hickory brace between them, he secured expansion of the lateral portions of the arch, and by forcing a longer brace between

the sections from time to time he was able to establish original occlusion of the remaining teeth in each arch. This is the first authentic report of the gradual reduction of mandibular fractures.[19] During the World War, bulky splints, cast in sections and joined by some form of jackscrew or spring wire, were quite universally used for gradual reduction. The French were the first to use a neatly designed appliance, closely patterned after our old orthodontic appliances, for gradual reduction by means of elastic traction.[20] Refinements in design are possible by means of our later developments by the use of elastic traction or the coil spring.

Edentulous fragments in fractures of the mandible have been among the most difficult problems of reduction and fixation. Invariably, attempts at direct wiring of compound fractures, after fruitless efforts by other means of reduction, usually result in a series of complications. Various types of splints designed with vulcanite rests or other means of stabilization for the control of the edentulous fragment were used by the early men in dentistry and by our prosthodontists during the war. They were unsatisfactory because the pressure on the soft tissue caused necrosis. Kingsley devised another method which was the application of a common method now in use in orthopedics today. By engaging a short piece of heavy wire (or the sharpened handle of a dental instrument) in the vulcanite near the maxillary third molar of an interdental splint, it was possible to control the fragment. This spike or wire was directed downward and outward so as to engage the edentulous fragment in the region of the external oblique line and was just long enough so that with the teeth forced into the splint, the ends of the fragments would be held in perfect apposition. This plan has been used with the more recent cast splints during the last decade. Extraoral arms with sharpened extensions piercing the masseter muscle and controlling the movements of the ramus have been used very successfully.[4] An orthodontic appliance constructed of large gauge wire for the mandibular teeth and with a 14 gauge iridioplatinum wire soldered to the molar band, similar to the idea of Kingsley, will control the edentulous fragment in many of these cases. This type of appliance has sufficient stability and is far more comfortable for the patient because it permits limited movement of the mandible.

In the treatment of unreduced maxillary fractures, those with loose fibrous union, and those with small loss of osseous structure, it is evident that an essential part of the treatment can best be accomplished by means of orthodontic measures for slow reduction. Although callus formation arrests the mobility of the fragments, still the callus is capable of change by manipulation and extension, under mechanical force. It has been demonstrated that the stimulating force of an orthodontic appliance in these cases brings about tissue changes with rarefaction and ultimate ossification. Rubber elastics for traction with intermaxillary anchorage will bring about the restoration of original occlusion. The change in the bony structures is definitely stimulated by this traction and is exactly the same as the change produced in bone in the usual orthodontic treatment except that the bony fragments move as the occlusion is reestablished. Cell stimulation but not cell irritation or inflammation determines the physiologic limits for the applied therapy producing the change in form which must be produced in the restoration of original occlusion. Long extraoral arms for the ap-

plication of traction are contraindicated, for the continuous force of elastics used with such splints exerts a stress beyond the physiologic limits and results in a pathologic condition and fibrosis.[21] This prolongs treatment and adds to the endless number of complications and discomforts to the patient.

The increasing number of maxillary injuries with the destructive mutilations require the most intelligent and earnest attention of dentistry. This survey of the views of the plastic and oral surgeons, of the prosthodontists, and the orthodontists clearly indicates the need for closer study, the recognition of opinions and abilities, and hearty cooperation among these specialists. The broad application of orthodontics in this field and the ease and comfort with which it can be applied amply justify the honest convictions of those who can best interpret its usefulness in the field of maxillofacial surgery. Every large city should have maxillofacial groups available in its hospitals. Our dental schools should instruct the undergraduates as to the close relation of these specialists in the treatment of maxillary fractures, and this broad concept and its future development should be encouraged in postgraduate study. The prevention of permanent disability, the restoration to comfort and usefulness, and the enormous opportunity for good are but a few of the benefits gained by the application of orthodontics in the field of maxillofacial surgery.

REFERENCES

1. Villain, Georges: Traitement Physiologique des Fractures Mandibulaires et Moyens Mecaniques de Realiser cette Therapeutique, L'Odontologie **4**: 131, 1917.
2. Eby, J. D.: Principles of Orthodontia in the Treatment of Maxillo-Facial Injuries, INT. J. ORTH. **6**: 273, 1920.
3. Pickerill, H. P.: Methods of Control of Fragments in Gun-shot Wounds of the Jaws, Brit. J. D. Sc. **51**: 365, 1918.
4. Bodine, R. L.: Maxillo-Facial Prosthesis, INT. J. ORTH. **14**: 1010, 1928.
5. Cole, P. P.: Ununited Fractures of the Mandible, Brit. J. Surg., p. 57, 1918.
6. Leriche, R., and Policard, A.: Physiology of Bone, St. Louis, 1928, The C. V. Mosby Company.
7. Kazanjian, V. H.: Suture des esquilles osseus pour l'immobilisation des fractures entendues du maxillaire inferieur, La Restauration Maxillo-Faciale, Paris, 1917, p. 169.
8. Kazanjian, V. H.: Prosthetic Appliances in Surgical Treatment of Wounds of the Face and Jaws, J. A. M. A. **73**: 1265, 1919.
9. Hume, G. G.: Orthodontia and Oral Surgery, INT. J. ORTH. **7**: 351, 1921.
10. Eby, J. D.: The Evolution of Orthoprosthodontia in Military Dental Surgery, J. A. D. A. **14**: 872, 1927.
11. Dunning, H. S.: Fractures of the Jaws, Int. J. Med. & Surg. **47**: 277, 1934.
12. Schaeffer, J. E., and Skinner, M. B.: The Therapy of Jaw Fractures and of Face Injuries, J. A. M. A. **105**: 1679, 1935.
13. Dorrance, G. M., and Loudenslager, P. E.: Fractures of the Jaws, S. Clin. North America **15**: 71, 1935.
14. Krohn, C.: Die Behandlung von Fractura colli mandibulae besonders bei Kindern und die Resultate von einigen Faellen, Deutsche Zahn- usw. Heilk. **1**: 16, 1934.
15. Moorehead, F. B.: A Better Method of Treating Fracture of the Jaws, J. A. M. A. **102**: 1655, 1934.
16. Piperno, A.: Modern Methods of Treating Jaw Fractures, Brit. D. J., 1916. War Supplement, p. 23.
17. Fairbank, L. C.: A Short History of the Treatment of Maxillary Fractures, Military Surgeon **78**: 95, 1936.
18. Yavlinsky, A. L.: Treatment of Fractures of the Jaws in Times of War and Peace, Orthopedia and Traumatology, Kharkov Inst. **8**: 75, 1934.
19. Suersen, Wilh.: Ueber Fracturen des Unterkiefers, Verh. Berl. med. Gesells. **4**: 57, 1871-73.
20. Chenet, H.: L'expansion elastique continue monomaxillaire dans le traitement des fractures du maxillaire inferieur, La Restauration Maxillo-Faciale, Paris, 1917, p. 219.
21. Miller, A. L.: Gradual Reduction of Fractures of the Maxilla and Mandible, Dental Summary **41**: 151, 1920.

DISCUSSION

Dr. Joseph D. Eby, New York City.—I believe this phase of orthodontics which Colonel Fairbank has presented should be regarded more seriously than it generally is. If I were a younger man in practice, I certainly would endeavor to establish some hospital connections whereby I could gain exercise and experience along those lines.

General orthopedic surgery embraces the surgical correction of given defects and gradual reductions of body defects by means of apparatus, and also sponsors, to a certain degree, the replacement of lost extremities artificially, hands or arms.

I believe dental orthopedics proper should cover more than orthodontics within itself, in that the work of the oral surgeon, the work of the orthodontist and the work of the prosthodontist would be similar in comparison with all that is done in general orthopedic surgery. Oral surgery and the mechanical making of splints, which is orthodontic in nature, and prosthodontics are intimately interrelated, and yet there are no two of the three which any one in the opposite branch would be completely qualified to perform. In most instances the oral surgeon, although a dentist, has little equipment and has not had sufficient exercise in the designing of splints and their insertion; and, if he assumes that responsibility, he is adding to his own surgical risk and is laying himself much more open to failure.

In the case of a fracture of or an injury about the maxillary or mandibular bones, I believe we could say that, basically, the first rule would be the reduction of that fracture or that injury as quickly as possible, or we may say as nearly immediately as possible, as soon as any attending condition such as shock or hemorrhage will permit. In private life, dentists and orthodontists, of course, have the equipment and the facilities to act expeditiously in that respect. In the case of war injuries, where wounds are obtained in the zone of advance, often attenuated by other wounds much more serious in nature and character, of course the early first aid treatment may be very inadequate. Before the injury can be treated, the patient has to be transported back, with a greater or lesser degree of difficulty, to an intermediate area where first aid may be given and intermediate splints may be inserted; and when those patients get back to the zone of the interior, an entirely different form of splinting apparatus more reconstructive in nature is indicated. That is where the Army is beautifully facilitated for that purpose. From my own observation, it was always found that the length of time necessary to produce what we might call the degree of maximum improvement was almost directly proportionate to the nature and the character of the first aid treatment the patient received.

The injuries which healed most quickly with less expense to the government in cost of repair and ultimate disability were generally traceable to dental officers who had sufficient genius to overcome their own obstacles and did such fine early work that the case healed more or less uneventfully.

Colonel Fairbank has shown his customary thoroughness in the manner in which he reviewed references and, in combining that with his own personal experience, has given us a paper which I believe will be regarded as a standard on this subject in modern orthodontic literature.

ENDOCRINOLOGY AS RELATED TO ORTHODONTIA*

A. F. Heimlich, D.D.S., Santa Barbara, Calif.

THE time has come when orthodontists may no longer say with safety that too little is known of the endocrine glands to give this subject serious consideration. All orthodontic cases are dependent directly and indirectly on the proper functioning of all the endocrine glands; for it is necessary that these glands function normally in order that metabolism may be normal, and there is no questioning the fact that physiologic tooth movement is dependent on normal metabolism.

Endocrinology is fundamentally biologic, having for its foundation biochemistry, which includes all the reactions of the body. Three interrelated forces mold the individual and control growth and development. All that we are and hope to be, is determined in our germinal protoplasm, which is handed down from previous generations and is the deepest level in developmental forces. These fundamental characteristics are influenced endogenously by the status of our physiology, in which endocrines play the most important rôle, and exogenously by environment, or external factors, such as diet, disease, climatic change, psychic effects, etc. Here, too, the endocrine glands through their secretions play an active part in stabilizing metabolic functions.

That developmental forces are definitely interlinked has been demonstrated by Rowntree[1] in his classical experiments on rats. He found that by injecting successive generations of parent rats with thymus extract a wonderful acceleration in the growth and development of the offspring took place; this acceleration increased with each succeeding generation. In the fifth generation teeth were erupted and ears developed on the first day. The eyes were opened and the animals were covered with fur on the third day. Adolescence was greatly accelerated.

The endocrine glands resemble chemical laboratories in that they select particular substances from the blood and make out of them chemical substances having specific qualities. These substances are known as hormones, and are transferred from their place of origin to other parts of the body by the blood stream. In their new locations they have the power of modifying either structure or function.

As an example of the potency of the hormones, one-thirtieth of a gram of thyroxin is sufficient to increase oxidation in the human body by 1 per cent, and adrenine introduced directly into the blood stream exerts a definitely appreciable effect when its concentration is only one part in four hundred million.

*Presented to the American Board of Orthodontia.

In this paper I propose to give a brief outline of the principal glands of internal secretion together with some of their known hormones and functions, after which I shall proceed with the relationship of orthodontia to the endocrine field.

Of the thyroid gland Hoskins[2] says: "It straddles the trachea at the base of the neck like a well-filled pair of panniers thrown across the back of a pack animal. The panniers represent the right and left lobes, and the sling represents the isthmus of the gland." It is this structure which becomes swollen to give the familiar aspect of goiter. The weight of this gland is about one ounce.

The thyroid gland regulates in a large part the speed of metabolism and especially the unfolding or metamorphosis of all the tissues during growth and development.

Thyroxin, the known hormone of the thyroid gland, was first isolated by Kendall of the Mayo Clinic. Cannon[3] tells us that shifts in the thyroxin level are accompanied by changes in function of the liver, pancreas, pituitary, and adrenal glands.

The thyroid helps us to adapt ourselves to environmental changes, such as diet, climate, and all other conditions in which a change of pace in metabolism is demanded.

The pronounced clinical manifestations of deficiency of the thyroid gland are naturally very striking, particularly in early life. Among them are defective brain development, undeveloped sex organs, slackness of muscles, subnormal temperature, thick badly nourished skin, coarse hair, sparse and dry, subnormal metabolic rate. In short we have a startling picture of deranged metabolism.

The parathyroids are four in number. They usually lie in pairs on the inner side and toward the back of each lobe of the thyroid. In weight they amount to only two grams apiece; however, their removal causes a severe nervous tension in all parts of the body leading to tetany and convulsions. The parathyroid glands secrete parathormone, which is of value in some forms of tetany. Parathormone is active in the mobilization and use of calcium and is also supposed by many to have a catalytic action in the acceleration and retardation of calcium metabolism.

The pituitary gland is situated near the center of the head in that portion of the sphenoid bone known as the sella turcica. It weighs only ten grains, but exercises a profound influence on the physiologic processes of the body. The pituitary is composed of an anterior and a posterior lobe between which is situated the pars intermedia, which is really a remnant of the infundibulum. The wonderful complexity of the pituitary is partly indicated by the number of hormones emanating from it and its interrelation with other endocrine glands. The anterior lobe secretes hormones regulating growth. It is also intimately associated with the gonads, the thyroids, the adrenals, and the parathyroids. The posterior lobe has to do with water metabolism and supposedly pigment metabolism; though this latter may be under the jurisdiction of the pars intermedia. The posterior lobe also exercises an influence on smooth muscle activity and presumably on blood pressure

Many of the fundamental processes of the body are under dual control, hormone and nervous. In this connection it is interesting to note that there seems to be a close relationship between the brain and the pituitary gland. The most characteristic diseases due to pituitary disturbances are gigantism, acromegaly, and dwarfism.

The adrenals are two in number and as Hoskins[2] says, "perched like a cocked hat over the upper part of each kidney"; together they weigh only about one-quarter of an ounce. They are composed of two parts, the medulla, which is the inner portion, and the cortex, which surrounds it. The medulla secretes the hormone, adrenalin or adrenine, which may be called an emergency hormone. Cannon[3] says that under conditions of special stress adrenalin is automatically discharged into the body, the sympathetic nervous system is reinforced, and the entire body becomes fortified for muscular activity. The medulla is also instrumental in pigment metabolism. The cortex is essential to life. Its complete removal proves fatal. It is concerned with salt, water, sulphur, and carbohydrate metabolism. It has a strong gonadotropic action, and possibly aids in the regulation of blood pressure. Hartman[4] of Buffalo isolated the hormone cortin, which is a specific in Addison's disease, an adrenal deficiency. Without the aid of cortin the patient cannot recover. Cortin may prove to be useful as a general cell stimulant.

The thymus is placed in the upper portion of the chest cavity. It is composed of two lobes, the right being the smaller. It varies in size during life. At birth it is between one-fourth and one-half ounce in weight. It increases in size until adolescence when it reaches a weight of about one ounce; thereafter it suffers some degeneration, but usually persists to old age.

It has been suggested that the thymus exerts an antitoxin function and also that it is instrumental in the production of white blood corpuscles. The experiments of Rowntree noted above are outstanding.

The pineal is, as its name suggests, a cone-shaped gland, attached to the brain near the pituitary and is quite small, weighing only about two grains. Very little is known of its functions. It has been noted, however, that a tumor of this gland leads to the clinical syndrome of macrogenitosomia praecox or premature sexual development.

The gonads, male and female, regulate the primary and secondary sex characteristics and determine sex and sex activity. Their influence on the body economy is profound.

The functions of the stomach, pancreas, gallbladder, and intestines are influenced greatly by three hormones. Gastrin, formed from the lining of the stomach, stimulates the secretion of gastric juice. Secretin, formed mainly in the intestines, together with the aid of the nervous system, serves to control the secretions of pancreatic juice. A third hormone, cholecystokinin, derived from the same sources, causes contraction of the gallbladder and the ejection of its contents into the upper intestine during digestion. Adrenine and thyroxin are also supposed to play a part in gastrointestinal activity. Some evidence also points to insulin, a pancreatic hormone, as playing a part in gastrointestinal functions.

A classical endocrinopathy is the result of a long-standing metabolic imbalance which has been cumulative in character and complicated by the close interrelation of all the glands. Probably it had its inception in childhood. The inception of most endocrinopathies is as insidious as growth and development themselves.

It is impossible at this time to attribute a specific malocclusion of the teeth to a definite endocrinopathy. Regardless of the fact that a patient shows a definite hypothyroidism at the time orthodontic treatment was started, there is no way of knowing what interrelations of endocrine imbalance were active in the development of the conditions as shown when the case presented.

For this reason, early diagnosis is extremely difficult and must be left to the specialist. The clinical picture as it presents to the orthodontist may well be confusing and often contradictory.

Regardless of the difficulties involved, the orthodontist should be able to detect the presence of glandular pathologic conditions. This done, he is in a position intelligently to refer such a case to a competent man for treatment. To this end the orthodontist must make himself familiar with the clinical manifestations of glandular imbalance. This may be accomplished through study, through observation of classical cases, preferably in an endocrine clinic, and through training himself to be on the alert for any signs of endocrine pathologic conditions that may present in his practice. In this connection a list of signs suggestive of endocrine imbalance should prove of value.

SUGGESTIVE SIGNS[5]

I. Physical
- A. Personality
  1. Overactivity or hyperirritability
  2. Underactivity or apathy
  3. Mental retardation
- B. Weight
  1. Marked overweight for age
  2. Marked underweight for age
- C. Height
  1. Marked overheight for age
  2. Marked underheight for age
- D. Configuration
  1. Bony disproportion
  2. Abnormal fat distribution
- E. Skin—any marked deviation from normalcy in
  1. Temperature
  2. Texture
  3. Pigmentation
- F. Hair
  1. Abnormal hair distribution

G. Eyes
   1. Protruding
   2. Slanting
   3. Irritated lids

H. Nose
   1. Underdeveloped
   2. Retroussé

I. Mouth
   1. Delayed dentition, rapid caries, abnormal spacing, prognathism, and abnormalities and not otherwise accounted for
   2. Broad tongue

J. Neck
   1. Enlarged thyroid

K. Extremities
   1. Abnormally large or small hand
   2. Abnormally long or short fingers (spade hand)
   3. Tremor of fingers
   4. Polydactylism

In addition to these signs, laboratory findings are of great importance. A routine roentgenogram examination of the wrist is essential at the outset of treatment when full mouth roentgenograms are taken. These pictures show the true physiologic age of the patient as compared with the chronologic age. While bone development in other parts of the body is of great value in determining physiologic age, the bones of the wrist are particularly suitable for such a determination; being first laid down in cartilage, they are transformed into bone by the laying down of mineral salts. The various ossification centers are filled out in a regular predetermined order. Fig. 1 is a chart prepared by Shelton[5] showing normal wrist development. Having determined normal development of the wrist for the corresponding age of the patient, we can now readily tell whether or not the patient is advanced or retarded in bone growth.

The orthodontist should familiarize himself with the various laboratory aids in diagnosis; both to increase his general knowledge of the subject and in order to discuss them intelligently with the physician and the parent. These tests include basal rate, wrist and sella turcica roentgenograms, urinalysis, sugar tolerance tests, and blood findings.

Suggestive signs as indicated by laboratory findings are as follows:

1. Basal metabolic rate: high or low
2. Roentgenologic findings:
   a. Retarded or advanced bone age
   b. Abnormal sella turcica
   c. Decalcification or abnormal calcium deposition
   d. Enlarged thymus

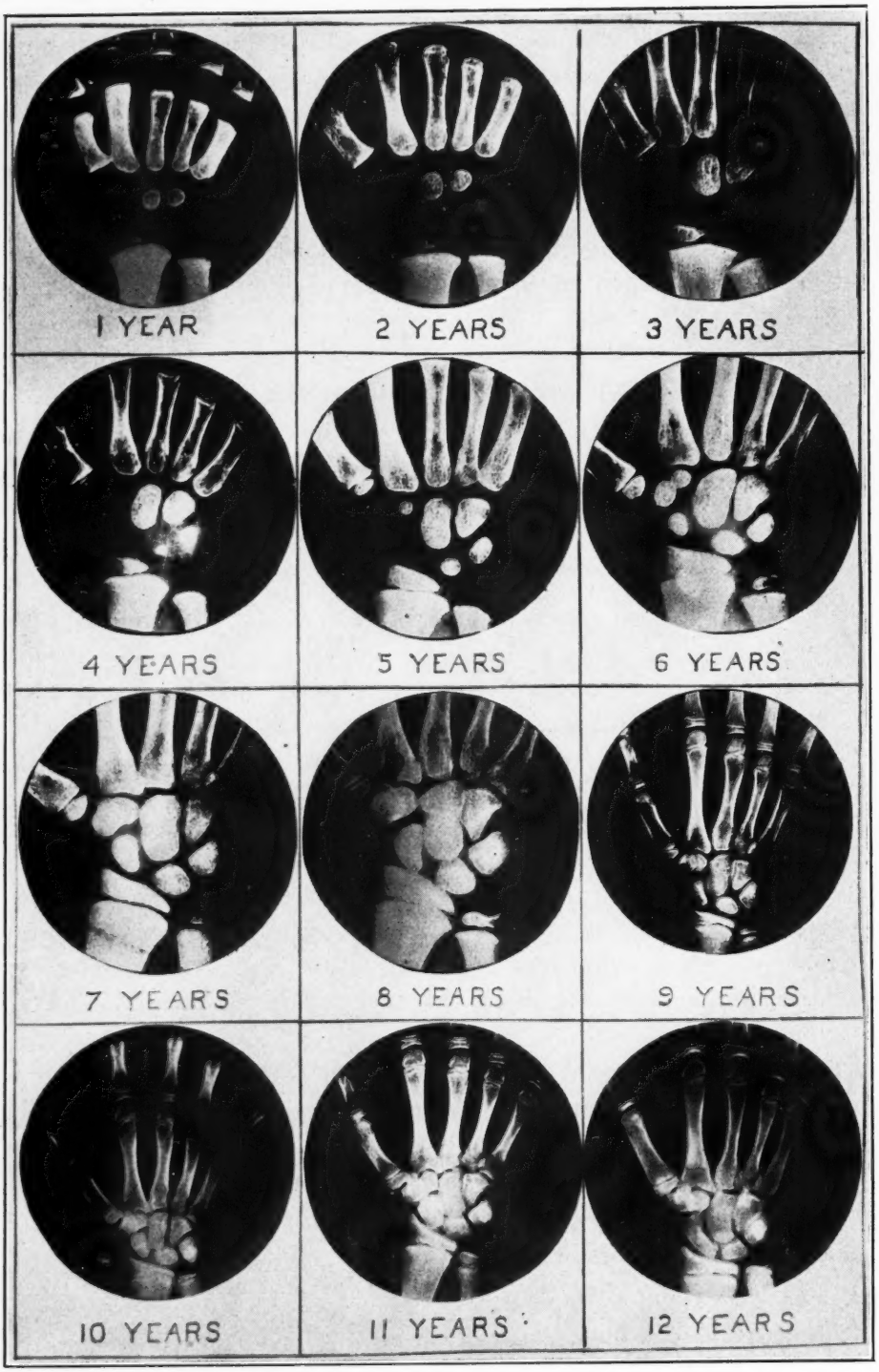

Fig. 1.—Wrist chart.

3. Urinary findings abnormal as to:
   a. Presence of sugar
   b. Absence of creatin in childhood
   c. Excessive urinary output
   d. Very low specific gravity
4. Blood findings abnormal as to:
   a. High or low glucose
   b. High or low calcium values
   c. High or low phosphorus values

It is extremely important that the orthodontist make no attempt either to diagnose or to treat endocrine disorder. Any one or more of the diagnostic signs may fail. For example, there may be an advanced bone age or a normal metabolic rate in hypothyroidism. It takes a man skilled in endocrinology to piece together conflicting symptoms, to see the entire picture, and finally to arrive at the proper diagnosis and treatment.

Occasionally we have cases that present to us no clinical symptoms of metabolic disturbance but are resistant to treatment. In these instances endocrine imbalance should be suspected.

The ultimate goal would be to educate the parents of our patients to the point where every patient before undergoing orthodontic treatment would have a metabolic check-up.

How may we relate orthodontia more closely with endocrinology? This question is partly answered by the foregoing. In addition a vast number of endocrine case histories should be made in collaboration with orthodontists. Models should be taken before and after endocrine treatment where no orthodontic therapy had been instituted, thus ascertaining the response of the teeth and surrounding structures to endocrine treatment.

Given a fair knowledge of endocrinology, what practical benefits may we as orthodontists hope to derive? By having metabolic imbalances corrected or proved absent we may proceed in treatment with more assurance of normal tooth movement, better and more permanent retention, and less fear of decay.

REFERENCES

1. Rowntree, L. G.: Biologic Effects of Thymus Extract, J. A. M. A. **103**: 1425, 1934.
2. Hoskins, R. G.: Tides of Life, New York, 1933, W. W. Norton & Co., Inc.
3. Cannon, W. B.: Wisdom of the Body, New York, 1932, W. W. Norton & Co., Inc.
4. Hartman, F. A. T.: Studies on the Function and Clinical Use of Cortin, Ann. Int. Med. **7**: 6, 1933.
5. Shelton, E. Kost: Roentgenographic Studies in Normal Osseous Development, J. A. M. A. **96**: 759, 1931.
   Osseous Development as an Index of Metabolism, Radiology **20**: 241, 1933.
   Osseous Development as an Index of Metabolic Speed, Endocrinology **17**: 667, 1933.
   Familial Hypothyroidism, Endocrinology **15**: 296, 1931.

OPEN-BITE*

Dr. Lucien de Coster, Brussels, Belgium

NORMAL occlusion may be studied in three dimensions: sagittal, frontal, and vertical. The vertical relations may suffer disturbance in two ways: by either excess or lack of vertical occlusion. Excessive vertical occlusion is called surocclusion; insufficient vertical occlusion is called open-bite, inocclusion or infraclusion. The opening of the bite may be limited only to incisors or it may extend to the premolar and molar regions, and a complete inocclusion of all the teeth is not unknown. In several cases we meet with local open-bite at one or another part of the arch.

In order to delimit the notion of open-bite malocclusion, we shall not consider the cases produced by sagittal malrelations and shall only consider as open-bite cases of vertical inocclusion from a plane passing through the occluding teeth.

What is the place of open-bite in the principal classification? One can divide previous classifications into three categories:

(1) Those which take into account incisor relations only.
(2) Those which take into account molar relations.
(3) Those which take into account facioeranial relations.

In the first category was Carabelli, who was also the first to name this malocclusion (*mordex apertus*) by its most prominent symptoms. Nothing, however, was elucidated about the anatomic relations. Welcker called open-bite "hiatodont" and stated: "when the superior and inferior arches are closed, a hiatus remains unclosed between upper and lower incisors, and this opening of the bite can be prolonged to premolar and molar regions." Izlia made a separate class of open-bite malocclusion-opharmosis, divided in two subdivisions: (*a*) The inferior arch is smaller than the superior (opharmosin or enharmosin disposita), (*b*) the superior arch smaller than inferior (opharmosin ad epharmosin disposita). In the same way as Carabelli and Welcker, this author classified open-bite as a distinct malocclusion, but not without recognition of the fact that all morphologic signs are not of the same value. Angle considered open-bite as only a part of his first malocclusion, and did not further consider it as a distinct malformation.

On the other hand, Calvin Case considered it as a particular malformation and described it as his seventh class. Simon no longer acknowledges open-bite as a peculiar individuality. By use of the Frankfort horizontal plane he has distinguished several possible types:

(*a*) Upper dental attraction: incisive, posterior, total.
(*b*) Upper maxillary attraction: incisive, posterior, total.

*Read before the European Orthodontological Society at Scheveningen, Holland, May, 1934.

(*c*) Mandibular dental attraction: incisive, posterior, total.

(*d*) Mandibular abstraction: abstraction of gnathion, abstraction of gonion, abstraction of gnathion and gonion, or total.

This latter classification is certainly much more perfect and logical than the previous classifications. Frey and Nevreze made a systematic study of open-bite morphology and described the following lesions:

(*a*) Alveolar lesions.

(*b*) Maxillary lesions (nasal parts, dylus, temporomaxillary articulation).

Herbst, Villain, etc., have placed open-bite among the vertical malrelations.

FREQUENCY

Open-bite may be deemed a rare malocclusion. Without positive statements, one can judge by the fact that Milo Hellmann found only 43 cases of open-bite and G. Korkhaus gathered recently 68 of them for his important study. It may be interesting to inquire how open-bite stands in relation to:

(*a*) *The question of age:* Korkhaus and Kantorowicz stated that at six years of age open-bite was found in 42 cases per thousand, but at fourteen years of age only 25 per cent of these were established.

(*b*) *The social standing:* Serious cases are most often met with in hospital clinics, while the cases coming to the ordinary private practitioners are usually less severe, showing that the nurseries and good feeding of the rich are of value as a prophylaxis.

LESIONAL ANALYSIS

Literature on the question of open-bite shows us that even if we are in agreement as to the principal symptoms of this malformation, this is by no means the case when we wish to localize the lesions which are the basis of these fundamental symptoms. This is clearly apparent when we examine the accessory symptoms described by the authors; and also the varying successes of therapeutic interventions. Milo Hellmann, in his work on the open-bite, tells us of the result of a questionnaire sent to the principal American orthodontists. While a certain number of answers indicated 100 per cent of success and others 100 per cent of failure, the majority came to the conclusion that 50 per cent of successes and 50 per cent of failures were the correct averages. Milo Hellmann himself made researches in order to determine what was the percentage of successes and failures among his clients. Out of the 43 cases that have come to his knowledge, he treated only 18 cases; 3 out of the 18 gave excellent results, that is 16.7 per cent; 8 cases were successful, or 44.4 per cent, and the result was meager in 6 cases, or 33.3 per cent. One patient was sent to another orthodontist. Of the 25 others which were not treated, 14 were not seen again, 4 improved without treatment, and 7 are still under observation. He has calculated that the percentage of the cases which improved without treatment is the same as the percentage of the good results of treated cases, that is 16 per cent. Korkhaus remarks on the existence of real open-bite which he distinguishes from other cases of similar symptomatology, but which exist rather through anomalies of com-

pression or are due to thumb-sucking. Hellmann points out the existence of open-bite in the first as well as in the second and third class of Angle.

All of which indicates that what we should at first search for as the first stage of systematic study of this malformation is the symptomatology of the open-bite, and to try to divide the cases into groups of similar form.

THE OPENING OF THE ARCHES

If we express the co-relation of the arches one to the other, according to Lischer, by equidistant curves, we can imagine the various possible forms of open-bite.

(1) The bite is open but the general curve of the arch is maintained.
  (*a*) Deviation of the two arches in their anterior part.
  (*b*) Deviation of a single arch: maxillary, mandibular.

(2) The line of occlusion is broken, owing to an abnormal inclination that can be placed at any place on the line of occlusion of
  (*a*) The two arches.
  (*b*) A single arch: maxillary, mandibular.

(3) The rupture of the line of occlusion is local: maxillary—anterior, posterior; mandibular—anterior, posterior.

Associated with these deviations we may meet with compressions of the arch and all the sagittal deviations in one sense or another. According to this logical classification we may say that we may meet with different lesions. In fact, the first class may be produced by the impossibility of closing the bite, due to:

(*a*) A lesion of the temporomaxillary articulation.
(*b*) A muscular lesion which prevents closing the mouth.
(*c*) An insufficient length of the vertical part of the mandible.
(*d*) An increase of articular height at the molar level.
(*e*) An insufficient development of the skull and an exaggerated inclination of the anterior part of the cranial base.
(*f*) An insufficient development of the anterior part of the mandible.

In the second category we have cases in which the arch or the maxilla is affected, localized either in the maxilla or in the mandible, affording a view of purely mechanical deformation.

In most of the very serious cases we see lesions of the first and of the second category combined. In the third class are to be found cases of limitless deviation. These data correspond to the different classes of Simon. Rogers distinguished the infraocclusions as: anterior, posterior, monomaxillar, bimaxillar. Korkhaus distinguishes the possible localizations of open-bite in the following ways:

(*a*) A vertical curvature of the anterior part of the maxilla.
(*b*) A vertical curvature at the base of the mandible.
(c) Oblique position of the maxillary and mandibular alveolar processes owing to compression of the jaw.
(*d*) A diminution of the angle of the mandible by traction of the masseter.

(*e*) By a diminution of the height of the anterior alveolar process owing to the shortness of the roots of the teeth, most cases showing hypoplasia, and sometimes also by inadequate eruption of these teeth.

Another consideration to be made is the inclination of the line of occlusion on the horizontal plane of Frankfort. The examination of this may enlighten us as to whether it is a question of the mandible or the maxilla.

SECONDARY LESIONS

Examination has proved to us that open-bite is not the only lesion which is met with in cases of open-bite malocclusions. More often this opening is accompanied by other symptoms limited to the arch, which we are now going to review briefly.

(*a*) In the first place, it is necessary to cite atresia or compression of the arch. This is so frequent that Korkhaus was able to say that the open-bite was in close relation with the lesions of compression. Angle has already made the same remark, and in his plan of treatment he points out that the first thing to be done is the expansion of the maxilla without troubling about the symptoms of open-bite. Out of 12 cases of open-bite, Korkhaus finds 8 cases of severe compression (more than 10 mm.). In the cases due to thumb-sucking, he thinks it is the compression which prevents spontaneous correction of the malocclusion. This compression is especially anterior and does not generally go in farther than the first molar.

(*b*) *Hypoplasia.*—Cases of associated hypoplasia of the enamel are very frequent, and in some this condition may be extremely serious. Korkhaus has found 11 out of 12 in serious cases. These diminutions of the height of the incisors, due to abrasion of the hypoplastic teeth, may in many cases apparently exaggerate the opening, and, according to Kantorowicz, be a determining cause of open-bite.

(*c*) *Form of the Arches.*—In the majority, arches of the maxilla are lengthened in an anteroposterior direction and flattened in the mandible. As we have most often a compression at the level of the premolars, the arch will take the shape of a lyre. There is, however, an exception in the cases of open-bite arising from tongue-sucking which gives a flattened shape to the jaw.

(*d*) *Occlusion.*—Angle readily places the open-bite malocclusions in his first class, and indeed it is certain that a majority of the cases have a normal occlusion. However, Milo Hellmann has already pointed out that they may also be met with in cases of the second and third classes. He finds a distal occlusion in 75 per cent of the worst cases; while if the total number are examined, 40 per cent of distal cases are to be found. There are, however, a few examples of mesial occlusion.

CEPHALOMETRIC SYMPTOMS

A great number of cephalometric symptoms have been found. Among the principal ones we may cite the following:

(*a*) *Facial Height.*—Sim Wallace has found the face lengthened anteriorly, shortened posteriorly and narrowed. Izard has noted the lengthening of the

nasomental distance with a receding of the anterior frontal plane. Herbst remarks that according to Schmidt open-bite is a question of a lengthened face. Korkhaus remarks also on a lengthening of the lower face with a receding of the dental group of the mandibular incisors.

In a desire to clear up the confusion of lesional knowledge of the open-bite, Milo Hellmann examined several skulls. He arrived at the following conclusions: His study has revealed the fact that the occlusal disturbance known under the name of open-bite is constantly associated with short ascending and horizontal rami, and not with an arrest of development in the incisor region. These relations are found to be the same in the cases which come in consultation to the orthodontist. The height of the face is normal or even enlarged, and especially in the upper region. The breadth of the bizygomatic distance, of the bicondylian and bicanine distances are diminished, while the size of the nasal apertures, both anterior and posterior, is greater. In depth, the palate and the mandible, as the dimensions of the ascending ramus show, the coronoid process and the dimensions of the arch and the mandibular base, are smaller than normal.

MANDIBULAR ANGLE

We have seen that Milo Hellmann found the mandibular angle was different. Frey and de Nevreze drew attention to this as long ago as 1906. They found a more obtuse angle and have distinguished an external and an internal angle. They pointed out that with the same external angle one can have different internal angles, the latter being dependent on the growth of the alveolar process. Izard has found an increase of the angle that can attain 140° and even 150°. The genial protuberance has almost entirely disappeared. According to Kantorowicz the angle can be accentuated by 10°. This increase of the angle results in the maxillary arch being no longer parallel to the mandibular arch, and makes with the former an open angle in a forward direction. Korkhaus has found values of 135° to 145° instead of 128°.

Personal Researches

Having at our disposal a certain number of open-bite cases, we have wished to control and determine the symptomatology of this malformation. We have taken 100 cases among the first which have come to hand. Out of the hundred cases we have taken 25 teleradiographs. Some of my colleagues have sent me some interesting cases: Dr. LeClercq has sent me four cases, and Dr. Biot one case. The others are under treatment in my clinic. Of the 100, 75 have been examined by model only.

These 75 cases enable us to account for all the malformations and the position of the teeth and arches, while the 25 teleradiographs have especial reference from the standpoint of the skeletal relations with the skull. To this end I have made meshes which will throw light on the relationship.

EXAMINATION OF ARCHES

(*a*) *The Form of the Arches.*—In the great majority of cases the arch takes the form of a lyre, that is to say, there is a narrowing at the level of the pre-

molars. This narrowing may continue up to the molars and even to the second molar. In certain cases, however, an arch is diminished evenly all around, and an absolutely normal shape is to be found.

(*b*) *Hypoplasia.*—I have come across hypoplasia of enamel in 37.2 per cent of my cases. If the very accentuated cases are examined, e.g., those in which the open-bite exceeds 10 mm., we find 80 per cent of cases of hypoplasia. If we take cases of 10 mm. and more, but less than 15 mm., we find 70.1 per cent.

(*c*) *Aperture of Arch.*—We have divided our cases into those in which we find an aperture of 15 mm. and over; those in which we find 10 mm. and over; those of 5 mm., 3 mm., and 2 mm. The cases of 10 mm. and over must be considered as cases of real open-bite in accordance with Korkhaus; among the other cases we may find cases approaching a real open-bite, and cases in which the aperture is due to a defect of occlusion owing to compression. The 3 and 2 mm. ones I consider as cases of (possible) spontaneous correction, probably because the obstacle which prevented exact occlusion has been removed. Among the 75 cases we find 7 in the first category; 10 in the second; 20 in the third; 28 in the fourth, and 8 in the last, with the following proportions: First class (15 mm.), 9.3 per cent; second class (10 mm.), 13.3 per cent; third class (5 mm.), 26.6 per cent; fourth class (3 mm.), 37.7 per cent; fifth class (2 mm.), 10.6 per cent. If we take the two classes which Korkhaus calls true open-bite, we shall have 22.6 per cent.

If we examine the aperture of these cases in the age group in which the most accentuated are to be found, we perceive that in the first category the average age is 15 years, while in the second the age is 13.5. The third gives us 8.9 as an average, the fourth 9.2, and the fifth 7.4. It is necessary, however, to take into account the fact that the cases examined are of patients undergoing orthodontic treatment, and up to now the number of very young patients is not very great.

(*d*) *Occlusion.*—It is interesting to know what kind of occlusion we may find in cases of open-bite. If we classify them after the method of Angle, we see that 54.3 per cent belong to the first class. In the second class we meet with 39.2 per cent of cases, and in the third class 3.39 per cent. If we take the classes of extreme open-bite separately, we find that we shall meet with 41.6 per cent of the first class, 41.6 per cent of the second class, and 16.6 per cent of the third class.

SECONDARY SYMPTOMS

(*a*) *Atresia.*—First category (15 mm.): Premolar width—average shrinkage, 6.3 mm.; minimum, 3.0 mm.; maximum, 12.5 mm. Molar width—average, 7.4 mm.; minimum, 1.5 mm.; maximum, 15.0 mm. Second category (10 mm.): Premolar width—average, 8.0 mm.; minimum, 3.0 mm.; maximum, 8.5 mm. Molar width—average, 4.8 mm.; minimum, 0.0 mm.; maximum, 9.5 mm. Third category (5 mm.): Premolar width—average, 4.5 mm.; minimum, 0.0 mm.; maximum, 10.5 mm. Molar width—average, 4.3 mm.; minimum, 0.0 mm.; maximum, 9.0 mm. Fourth category (3 mm.): Premolar width—average, 5.8 mm.; minimum, 0.0 mm.; maximum, 12.0 mm. Molar width—average, 7.6 mm.; minimum, 0.0 mm.; maximum, 14.0 mm.

We see that atresia seems to have a correlation with the open-bite, but we note, however, considerable variations in the possible minimum and maximum. If we classify them by age, we shall see that over the age of 12 years there is an average shrinkage of 5.7 mm. for premolars and molar distances.

Under 12 years of age we have respectively 4.7 and 5.9 mm. Out of all these cases we have a clear evidence of atresia in 90.66 per cent. There is not atresia or even an increase of width in 9.33 per cent of the cases. Thus we see that atresia is an integral part of the malformation.

(*b*) *Disturbances of the Occlusal Plane.*—If we had made gnathostatic models, we should have been able to determine the inclination of the angle made by the line of occlusion on the horizontal plane of Frankfort, but in reality the open-bite is produced more often than not by a vertical deformation of the line of occlusion, or rather a part of this line. Teleradiography will explain to us more clearly what happens from the standpoint of the deviation of the line of occlusion from the horizontal plane.

From the models which we have examined the trouble which has occurred in the plane of occlusion was studied by taking the plane of molars, the articulation of which with the mandibular teeth is normal as a horizontal plane. The line of occlusion may undergo at a point more or less in the vicinity of incisors, a curvature in an upward direction for the maxilla and a lower direction for the mandible. We have measured the angle which the line of occlusion made with the plane of molar occlusion. Of course, this angle depends on the extent of the open-bite, but also on the spot where the curvature is made. The maximum angle which we have found is 60° in two cases corresponding to a deviation between the incisors of 15 mm.

We now examine the size of the open-bite in the most accentuated cases; that is to say, cases with more than 10 mm. aperture. We have divided these into cases in which the aperture of occlusion extends at least as far as the molars, and others in which it extends up to the first premolar and further. We have found 66.95 per cent are to be ranged in the first category and 4.7 per cent in the molar category. In the category of 3 mm. aperture we have 86.95 per cent of premolar aperture and 13 per cent of molar aperture, while in the last category of 2 mm. open-bite, 100 per cent of cases are in the premolar category. Out of the total we have 72.8 per cent for the premolar category and 37.1 per cent for the molar category.

These data then enable us to get an idea of the classification and importance of open-bite malocclusion. We see clearly that there must be cases of different sources. There are cases in which the open-bite affects only the intermaxillary bone, and others in which the lesions in question affect the whole of the maxilla or the mechanism of closure of the mandible or the temporomandibular articulation.

(*c*) *Protrusion or Retrusion.*—There is still another symptom which finds a place in symptomatology of the open-bite: the protrusion or retrusion of the anterior block. We measure this protrusion or retrusion simply by measuring the distances which the maxillary teeth overlap the mandibular in one direction

and then utilizing the calculations of Korkhaus by reckoning on his orthometer the distance between the incisor and the premolar width.

Out of the whole of our cases 86.4 per cent are cases of more or less accentuated protrusion, while 13.5 per cent have either abnormal occlusion of incisors in the sagittal direction or even retrusion. The average protrusion is 7.39 mm.: minimum 2 mm., maximum 20 mm. The average retrusion is 3.66 mm.: minimum 1 mm., maximum 10 mm.

If we examine again the relation of the protrusion to the size of the aperture we have: first category (15 mm.): 40 per cent of protrusion, 40 per cent of retrusion, 20 per cent of normal occlusion of incisors; second category (10 mm.): 85 per cent of protrusion, 14.2 per cent of retrusion.

If we take into account the calculations of Korkhaus, we have 66.6 per cent of cases which are in protrusion; that is to say, in which the maxillary teeth are protruding on the average calculated by Korkhaus in relation with the width of incisors. In 18.7 per cent of the cases we have a normal articulation of the incisors in a sagittal direction, and in 14.5 per cent this occlusion is in retrusion. The minimum of protrusion is 1 mm., the maximum being 6.5 mm.; the average is 3.3 mm.

In the mandible we meet with a diminution of the figures of Korkhaus in 80.8 per cent of cases, while we have the normal dimensions in 17 per cent of cases, and an increase of the figure in 4.2 per cent. The average figure is 2.89 mm. of diminution.

PALATINE VAULT

It was interesting to inquire whether the palatine vault was influenced by open-bite malocclusion, and we found that the palatine vault can indeed be influenced by the length of the face and by atresia of the maxilla.

The average height of the deformed cases is 17.3 mm. Korkhaus gives as average of normal figures 16 mm. The average of the cases of grave open-bite (15 to 10 mm.) is 19.6 mm.; the average of the cases of 15 mm. is 20 mm.; the average of the cases of 10 mm. being 19 mm.

We have thus examined the elementary points which the study of the models of the cases of open-bite can show us. We see clearly what are the repercussions or rather the relations of the open-bite with the other deformities or symptoms which we meet with in these cases. The similarity of the averages shows us at once that there is clearly a dissimilarity between the two types of malformation that have open-bite as a characteristic sign: (1) The type of case in which the opening of the bite seems simply to be a concomitant symptom of a more serious malformation, and (2) cases in which the opening seems to be the essential symptom.

To proceed a little farther in these researches, we are going to examine some radiographs in order to find out the morphogenic lesions accompanying a case of open-bite.

We have taken only 25 well-defined cases. We have taken a teleradiograph of each case, using Hoffrath's technic, that is at 2 meter 30 distance. In some

cases we have taken a frontal radiographic view in such a way as to show the transverse situation. From these records we have then taken a schema on the negatoscope. On this schema we applied a mesh according to the described technic.

Here is the rough idea of the technic of the meshing. Teleradiographic schema is used in the same way as a cephalometric schema. We establish normal schemas with a trace of the lines which correspond to the line of normality of the face in every way. There exists a normal schema for each stage of growth. We take the normal schema appropriate to the age of our patient. The lines of the normal mesh, forming on our standard schema several rectangles embracing

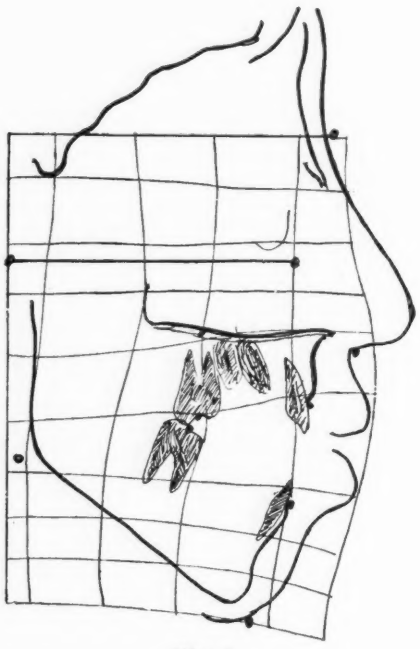

Fig. 1.

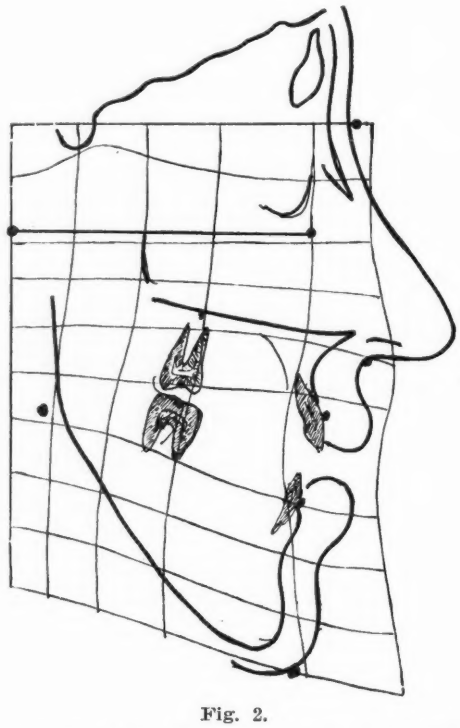

Fig. 2.

Fig. 1.—D., eight years of age. *Orbital part:* Vertical direction, high; sagittal direction, shortened; sella turcica, receded; nasion, receded. *Maxillary part:* Vertical direction—anterior, vertically shortened; posterior, normal; sagittal direction, mesiogression of the arch and palate. *Mandibular part:* Ascending ramus, normal; angle, normal but receded (distal); horizontal branch, normal; chin, normal.

Fig. 2.—X., twenty years of age. *Orbital part:* Vertical direction, high; sella turcica, highly situated; sagittal direction, shortened; nasion, receded to orbital point. *Maxillary part:* Vertical direction—anterior, shortened; posterior, more shortened than anterior part; sagittal direction—shortened in posterior region, normal in anterior region; alveolar process, shortened. *Mandibular part:* Ascending ramus, shortened; angle, opened and receded; horizontal branch, short; chin high.

the interesting anatomic points of the face, acquire a given relationship with these points. Either on our abnormal schema or directly on the radiograph we apply the lines of the mesh in such a way as to trace a meshwork about the anatomic points, presenting the same relations as in normal mesh. To safeguard these relations it is often necessary to deform the lines of the mesh. These deformations express the difference between the relative situation of the normal and the abnormal points and so express the deformity.

What facts does the mesh method enable us to establish? In order not to go into technical accounts I shall simply recall the conclusions of these studies. (Figs. 1-4.)

Sagittal Mesh.—In the orbital part of it we meet with cases in which the base of the skull is shortened in the sagittal direction, the sella turcica being too near the nasion. The orbital point is nearer to nasion on the normal as if the maxilla had protruded forward on the base of the skull. In other cases it is the contrary, the maxilla having receded toward the back of the skull. In the first case we perceive more often than not lesions of healed rachitis. In the second case the skull is abnormally big, and may even resemble a hydrocephalus. In the vertical direction we note that often the inclination of the sphenoid-nasion basal plane relative to the horizontal plane is greater than normal, owing to an insufficient aperture of angle of the base of the skull.

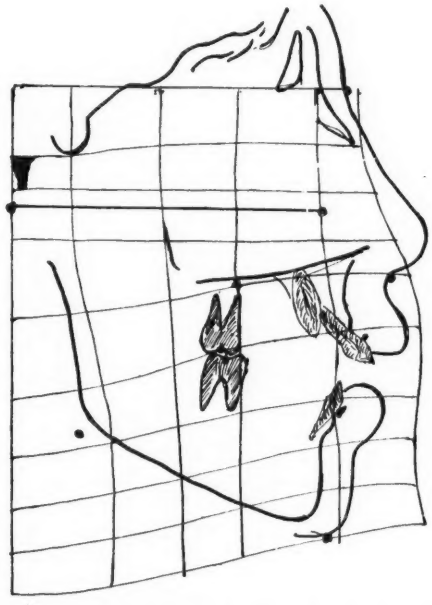

Fig. 3.—B., ten years of age. *Orbital part:* Vertical direction, normal; sella turcica, low; sagittal direction, shortened; nasion, receded to orbital point. *Maxillary part:* Vertical direction —anterior, vertically shortened; posterior, high; alveolar part, normal; sagittal direction, mesiogression of the whole maxilla. *Mandibular part:* Ascending ramus, higher than normal; angle, normal; inferior molar, highly situated; horizontal branch, shortened and protruded (mesial); chin, normal.

Certain other cases are absolutely normal as regards these facts.

In the first group we meet with the most serious cases. In the second group the cases are more simple.

The structure of the maxillary bones must be directly under the influence of the basis cranii. Indeed the maxilla is limited at the rear by the pterygoid wings of the sphenoid bone; in the frontal direction by the maxillary apophyses of the malar bone and the zygomatic arch, and also by the alae sphenoidei and by the development of the medial part of the ethmoid and components of the orbit. A lack of development of one of these bones will influence the static posi-

tion of the maxilla. But this maxillary bone may still undergo deformities on its own account. It is composed in reality of hollow bone forming a system of vaults (sinus, nasal cavity, etc.).

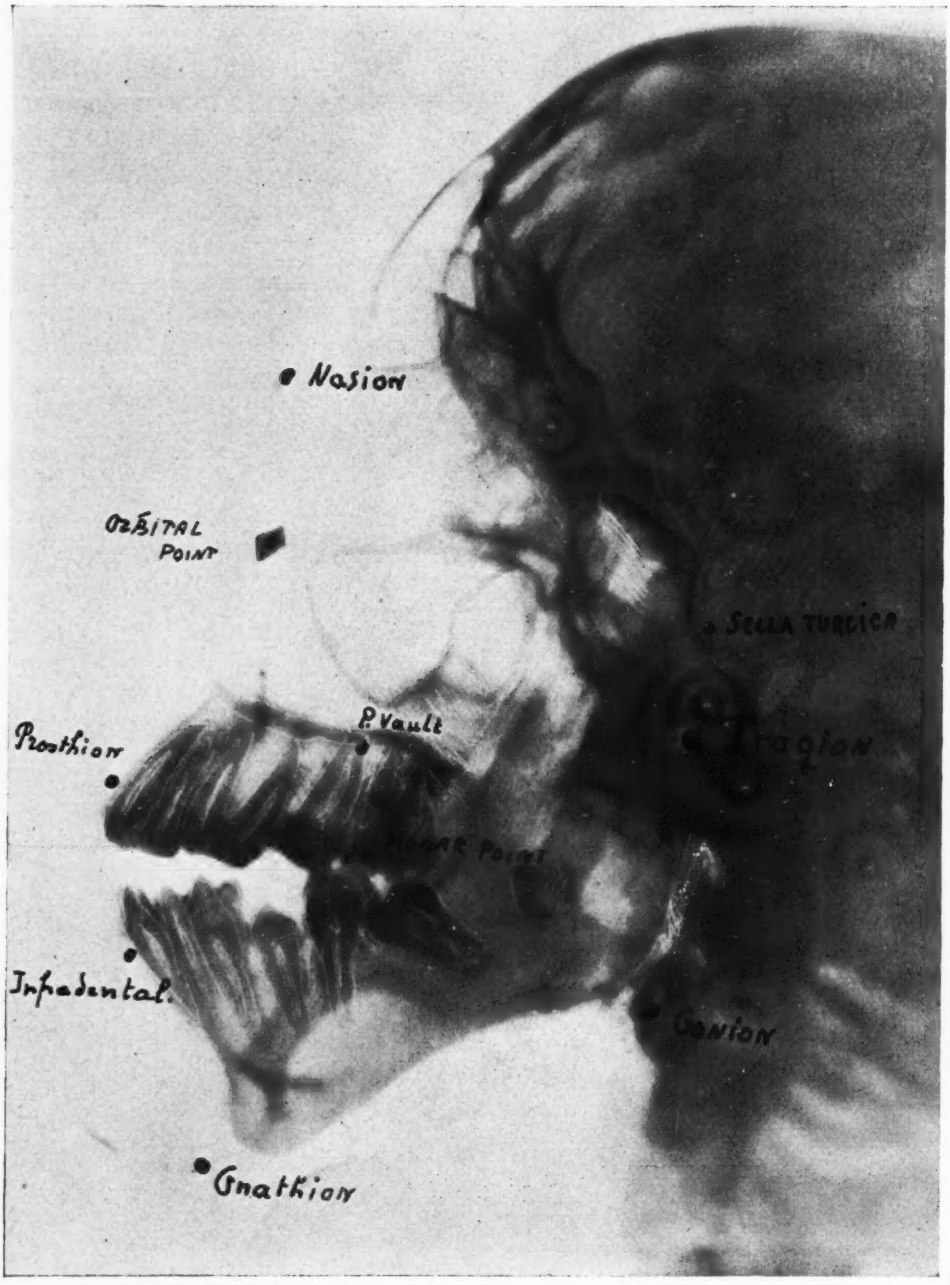

Fig. 4.—Microcephalic and micromandibular, girl of ten years. Open-bite results, on the one hand, from the maladaptation of facial bone to a reduced skull, and, on the other hand from maladaptation of a reduced mandible to a nearly normal maxilla.

What information does the sagittal mesh give us about this bone? We have lesions in a vertical direction and in a sagittal direction limited to different parts of the maxilla: basal part, alveolar part. It is necessary to distinguish the an-

terior part and the posterior part, corresponding on the one hand, to the molars and, on the other, to the incisors.

(*a*) *Basal Part.*—Anterior portion: sometimes greatly shortened in the vertical plane. In the sagittal plane we can have a recession of this part relative to the orbital point and nasion. This is the case in which open-bite is combined with mandibular prognathism and the nasal septum recedes.

Posterior portion: We see that the maxilla is higher than in the anterior part, and this is easily noticed from the curvature of the basal lamina of the palate. But there are also cases in which the bone is no longer high and in which we cannot conclude that there is a malformation of these parts.

We often see this posterior part of the maxilla shortened in the frontal direction as if it had not found sufficient room in which to develop; that is to say, between the first molar and the posterior edge of the palate and vomer where the distance is abnormally short.

(*b*) *Alveolar Part.*—It has been claimed that in cases of open-bite lesions of insufficient development of the alveolar process may be met. Only a small number of cases are to be found, and it must be said that in these cases we have to do with very short-rooted teeth which therefore require only slight support.

But we may come across cases with an exceptionally high alveolar process as if Nature had wished to compensate the lesions producing open-bite.

In the molar region we meet with an alveolar process as high as in the anterior part.

MANDIBULAR PART

Here we must distinguish between the part which corresponds to the ascending ramus of the mandible, and the part corresponding to the body of the bone and to the horizontal ramus, and that which corresponds to the angle and the mental part:

(*a*) *Ascending Ramus.*—In a great number of cases we find a shortened ascending ramus, which protrudes anteriorly. In certain cases, however, there is an ascending ramus which runs too far back, resulting in the phenomenon of a receding condyle in the articulation and in an inferior distal position.

(*b*) *Horizontal Ramus.*—There are many variations in the anteroposterior length of the horizontal branch; shortening is the variation most frequently found.

(*c*) *Mandibular Angle.*—With a few exceptions the mandibular angle is greater than usual and has remained infantile. In this region we may meet with extremely obtuse angles, almost even more obtuse than the mandibular angle of a newborn child. In many cases one cannot think that the patient has always had an open-bite, and one must consider that it is due to a curvature of the angle owing to rachitism or bone softening. An interesting fact to be considered is that in these cases we sometimes see this obtuseness of the angle produce a rising of the level of the mandibular arch to the level of the maxillary molars, producing opening of the occlusion.

(*d*) *Chin.*—The mental elevation undergoes numerous variations. In some cases, especially cases of very accentuated mandibular malformation, we find a

rather receding chin in relation to the position of the nasion. However, the shape of the chin does not seem to be influenced by the open-bite.

(*e*) *Alveolar Process.*—The height and the shape of the alveolar process can vary greatly. But it is certain that it is only in very few cases that the lesion is limited only to the alveolar process.

(*f*) *The Teeth.*—The teeth have something to say in the malformation because by the shortening of the roots we may have a shortening of the alveolar process and thus produce open-bite. Also the shrinkage of the teeth by hypoplasia of the enamel can give rise to a false open-bite.

CONCLUSIONS

We see then that far from being a lesional malformation limited to the alveolar region only and to the mandible, it extends also and in a very acute manner not only to the maxilla but also to the base of the skull. That accounts for the immense difficulty of reduction in certain cases. From the standpoint of lesional analysis the open-bite may evidently be caused by a simple local lesion situated either in the alveolar process, or due to the way in which the dental arches adapt themselves, or to the temporomaxillary articulation. But there are also more complex lesions, and they are those which arise from an incomplete or defective adaptation of the bones of the face at the base of the skull and also from maldevelopment of the jaw in itself in one or another of its parts.

It is thus evident from this work that open-bite, far from being a characteristic malformation, is only a symptom common to several malformations, a final symptom one might say.

Etiology

It is not an easy matter to establish an etiologic classification of dentofacial deformities. Brash pointed this out in his recent book. We cannot content ourselves with enumerating some of the well-known and accepted causes of malocclusion without definitely examining the scientific foundations of them. Before accepting a cause-and-effect relationship between a peculiar factor and a genuine malformation, one cannot content oneself with relating it to the presence of a given factor in the *curriculum vitae* of the individual at a certain time. Before coming to a conclusion we must eliminate all the other causes; try to show that the same cause always produces the same effect and, when possible, produces experimental confirmation of these views.

One sees easily that such a technic never has been applied to the study of malformations, and I doubt whether it was not impossible to apply it. On the other hand, it is uncommon to see a malformation resulting from a single factor uncomplicated by other etiologic causes, and also to meet with an absolutely simple malformation. Finally, a perfect etiology must be able to furnish adequate explanations of morphologic forms. Brash was right in stating that a very few of the well-known factors really correspond to the truth, and it is a fact that we have a false view of the relations between a factor and the malformations quoted as its result. I do not believe we can formulate a logical and

veracious etiology of open-bite malocclusions. Provisionally we must leave these considerations unaffected and study the etiologic situations from a less idealistic viewpoint.

Malformations can be produced in different ways:

(*a*) By total arrest of growth.

(*b*) By insufficient development of several parts.

(*c*) By absence of some points or exaggerated development.

(*d*) By lack of harmony of the chronology of development.

But in the second place we must consider function. Normal function can become prejudicial to the osseous static condition when the bone is in a pathologic state and vice versa. Can heredity influence fetal formation in such a way as to produce a characteristic open-bite? Without any absolute evidence, we may say that when open-bite is not an hereditary character, several morphologic factors of the face or the skull could be transmitted which should lead to open-bite malocclusions. Several oxycephalic cases can produce open-bite. The deformity is then only a secondary and annexed character, the result of the combination of favorable conditions.

In pathologic heredity, open-bite may result from the same combination of pathologic conditions. In the crossfire of morphologic variations of the different parts during growth and function, open-bite can occur as a quotient of a mathematical operation.

Suppose this is a syphilitic heredity; osseous pathologic phenomena can occur from either rachitic shape or osteodystrophic processes, and the final result can be open-bite.

This is not an open-bite heredity but a transmission of adjuvant systemic conditions.

INTRAUTERINE FACTORS

Weinberger related the influence of fetal positions in intrauterine life. Compression by weight or intrauterine pressures may be the basis of open-bite malocclusions. I remember seeing a newborn child having a normal mandibular angle at one side and a straight mandibular arch without angle on the other side.

Several diseases may at this time affect the normal development of the bone and give issue to serious malformations. We are concerned principally with fetal rachitism of peculiar gravity (osteodystrophia foetalis). Franke, Virchow, and Kaufmann have described the morphologic characteristics of these cases. A first group is distinguished by a peculiar sinking down of the base of the nose and a second group by a flattening and anteprojection of the whole nose. Virchow stated that a sudden closure by sclerotic process of the sutures of the bone of the cranial base, and principally in the median line, must be at the root of these malformations.

The radiographic plate will show a shortening of the nasion-sphenoidal distance. Osteodystrophia foetalis will not necessarily produce open-bite, but we get opening of the bite when the development of the maxillary and mandibular bones are both interfered with by cranial disease. Insufficient vertical growth of the maxillary bone and the shortening of the vertical ramus of mandible, com-

plicated by the fact that the cranial base remains in a vertical direction and so lengthens the face, will produce the most serious cases of open-bite. Several dysplasic processes can also disturb the normal course of fetal facial development: dystrophic disorders of the intermaxillary frontal lobe. Gradually we can obtain complete agenesis of the intermaxillary; nonfusion of the sutures producing harelip; or simple dystrophic development of this region. Vertical dystrophy of the intermaxillary bone will result in open-bite.

The operations of childbirth can be the cause of several injuries. Unfortunate traction on the jaws may injure the articulation of the mandible, the ligaments or menisci and so tend to insufficient epiphysis growth. A fracture of the neck of the condyle may be the cause of retarded growth. Infection of the temporomaxillary articulation can set up the same pathologic dystrophies.

POSTNATAL MALFORMATIONS

From the day of his birth the child can be influenced by all the causes of malnutrition of facial tissues and retarded growth: (1) traumatism; (2) infection; (3) constitutional defects of the chemical composition, structure and development of the bone.

1. *Traumatism.*—We shall call traumatism all the artificial influences which are able to disturb normal arrangements and development of the bony parts and dental bodies. Traumatic lesions such as heavy blows, falls, etc., can injure one or the other part of the developing maxilla or mandible and be at the base of a local dystrophy of the bone resulting in open-bite. Burn scars can draw down the mandible and open the bite. Absence of dental germs will naturally produce a gaping of the arches, and also cysts, nasal operations, fractures of the mandible, faulty reduction of temporomaxillary luxations, fractures of the neck of the condyle, etc.

Artificial pressures on the growing parts of the jaws may hinder the exact adaptation of the maxillary teeth on the mandibular ones. This artificial pressure can be effected by thumb-sucking, finger- or tongue-sucking and also by interposition of several objects. Here let us pause for a moment and consider the ways of open-bite production by artificial pressures.

Thumb-sucking Habits.—It may be said that thumb- and finger-sucking are often responsible for open-bite malocclusions, but every one who has studied such cases has stated that there is a wide variation in the individual susceptibility toward these malformations. Pressure of equal intensity will not always produce the same degree of deformity in different individuals. Factors other than finger habits have something to do with the final result. The right or left thumb is introduced in the mouth, the pulp upright and closely adapted to the palate behind the incisors; the nail resting on the mandibular incisors. The suction mechanism effects a narrowing pressure on the cheeks and also on the maxillary and mandibular alveolar border. We can now observe various effects according to different conditions of action and different conditions of plasticity of the bone. When we have to do with a special plastic condition of the alveolar bone, the maxillary teeth will protrude, narrowing the maxillary arch in its forward part. The pressure and the weight of the thumb will slightly pull the

mandible backward and give rise to a distal position of it. The mandibular incisors will flatten its anterior curve. When the mandible moves backward, the thumb will find a comfortable niche and the opening of the bite will be a very slight one. But when the mandible does not move backward, or when the alveolar bone is in a very plastic condition either by concurrent rickets or by the congestion of tooth eruption (the thumb may hinder the teeth from growing to their normal vertical level), or when the pressure is abnormally high, or the time factor very long, the sagittal projection of the intermaxillary process will become a vertical one and also the mandibular incisors may remain on a lower level than the occluding molars, producing an open angle with the horizontal plane of these.

The raising of these teeth and the lowering of the mandible may be made more important by a dropping position of the head and also when the second hand holds up the first. In fact, the main pressure of the thumb on the palatal and mandibular regions is exerted by the tonus of the muscles of the arm and forearm in pronation. The pillowing habit of the patient during thumb-sucking can change the morphologic findings.

Thumb-sucking can explain a great number of morphologic lesions, but when one considers the radiographic findings of lesional analysis and mesh method, one cannot explain the relatively serious malformation and insufficient growth of the maxillary bones. Can the thumb habit explain the uplifting of the basal plate of the palate and the vertical flattening of the maxillary in the anterior parts, according to the normal position, or even the lengthening of the molar regions?

It may definitely be said that other factors must have something to do with it too. Finger habits cannot give such heavy deformities as thumb-sucking. The open-bite will be more constant but less important. Thumb-and-finger together will produce a much larger deformity than the thumb or finger habit alone.

Tongue habits give rise to a peculiar variety of open-bite. All the teeth are spread open as the fingers of the hand, but much more in the forepart than in any other. When the tongue is only a little too large and does not remain between the arches, the open-bite will be very slight; but, when the tongue remains between the maxillary and mandibular teeth, as with a dog, there is a very peculiar form of open-bite (a stepwise opening of the bite). The interposition of inert materials such as dummies may be at the source of the aperture. I have seen an open-bite produced by the introduction of the neck of the milk bottle between the arches.

Pillowing Habits.—Stallard has reported several cases of malformation originated by pillowing habits and strengthened his theory by many illustrations. But when one considers the very hideous malformations which were produced according to Stallard by a simple pillowing habit, one cannot help doubting whether there was not another cause at the root of such a grave deformity.

2. *Infections of the Jaws and Surrounding Regions.*—Severe infections of the jaws such as osteomyelitis, infected cysts, local tumors of the jaw tissues, purulent diseases of the antrum, ozena, etc., can interfere with the development of the maxilla, just as infections of the temporomaxillary articulation and syphilitic osteitis of the jaw bones may disturb the normal evolution of the mandible.

3. ***Constitutional Disorders of the Chemical Composition, Structure and Development of the Bones.***—The principal disorders are rickets and glandular troubles.

(a) ***Rickets.***—Rachitis was said by Frey to be a very complete and polymorphonosologic syndrome, but essentially characterized by softening and deformation of the bony structures. Some authors attributed it to heredosyphilis and others to severe digestive infections. Recently rachitis has been included in the range of the avitaminoses (Mellanby, McCallum, Simmonds, etc.). But one wonders if all the symptoms associated with it can be due to a simple avitaminosis. Rachitic lesions are caused or favored by:

(*a*) Prolonged infections;

(*b*) Deficiency in calcium and phosphorus metabolism;

(*c*) Lack of sunlight and food with adequate vitamin content.

Its histologic lesions connect rickets with osteomalacia, osteoporosis, osteolymphatism and *ipso facto* with the great mass of endocrine disorders; faulty feeding, adenoids, digestive diseases, etc. Its evolution pursues the following course:

(1) Irritative phase (decalcifying chondromyelitis).

(2) Dystrophic phase. The decalcified tissue acquires a fibroid and spongoid structure. The bony skeleton has lost one of its principal qualities (rigidity) and may be deformed by the pull of musculature.

(3) The reparative phase. The spongoid bones become harder and wider than the normal bone, but most of the deformities are maintained in situ.

The muscular system is also involved in the rachitic lesions: hypotonic or neuromuscular catatonia.

Following these views the rachitic morphologic lesions must be ranged under three headings:

(1) Plastic deformation of the spongoid bone under the stress of muscular pressure and weight. The deformations will remain uncorrected after recovery.

(2) Malformation originated by the reparative processes. In fact a healed rachitic bone has lost a part of its growth faculty. The surrounding bones which were not rickety develop in the normal way. The discordance between the two sorts of bone structures will terminate as a malformation.

The muscular disease will produce malformation by the disequilibrium of the muscular bands. A great variation will naturally occur among different cases. The date of the rachitic attack and also the severity of the attacks will govern the degree of deformity.

By what mechanism can early rickets originate severe facial deformities?

The authors who occupied themselves with this question are not unanimous. Some hold rickets responsible for a great number of maxillary and facial deformities, while others, and among them Franke, do not believe in such a massive reaction.

Franke claims that the rachitic malformations are not due to rachitic deformities but partly to the softening of the osseous structure and partly to the retardation in growth mechanism originated by the pathologic factors which are responsible for rickets.

Ritter, Baginski, Shaw, Sella, Murray, Liharzik have shown that the bones of the face suffer from a diminution of growth tending to nanism. Franke found the same phenomena on skeletons of rachitic children. Severe attacks of early rickets are characterized by injuries to the skull bones as in the fetal dystrophic diseases but to a lesser degree. We can distinguish the following lesions:

(1) General softening of the skull producing craniotabes, characterized by an anteroposterior flattening of the cranial bones owing to pressure in a dorsoventral direction. The flattening of the occipital bone will produce an enlargement of the basal sphenoidal angle straightening the anterior part of the skull base. The frontal bone is one of the first to be involved and flattened, producing a flying forehead. The clinical schema will present a heavy head with a face flattened in a frontal direction. The orbits are displaced backward. The vertical inclination of the cranial bones lengthens the posterior part of the upper face and in the forepart the maxilla will be shortened.

Fig. 5.—Open-bite produced by oxycephalia.

A retardation of the vertical growth of the frontal lobe will directly create open-bite malocclusion.

When at the same time the vertical ramus is shortened and the angle opened, there will be a severe opening of the bite.

(2) When the softening of the bones have not involved the whole skull, several bones can arrest their development. The first bone which is affected by the rachitic softening in less severe cases is the frontal bone, also the other bones on the median line. The result can be a short basis cranii with a short maxilla, lateral parts having grown normally.

When the rachitic disease attacks the organism at a later age, the effects will be localized to the epiphyses. The mandible will have a large angle because of the pressure of the masticatory muscles, frequently attributed to tetanic contractions.

The more slight retardations of growth affecting the alveolar bone are of less serious character, and the rachitic etiology cannot be strictly proved. But altogether we can believe in a more or less severe attack of growth retardation at either the alveolar part or the angulus.

The rachitic etiology can be revealed at first by clinical inquiry, and second by manual exploration and radiographic findings. The radiographic schema of healed rachitism is very peculiar.

The general body growth can be disturbed by hormonal factors. But it must be said that the open-bite etiology in relation to hormonal troubles is not yet clear, and Brash is probably right when he says that hormones have no selective action on the jaws in the absence of other characteristic signs.

Nevertheless we know several types of malformations which are intimately concerned with hormonal disturbances, such as acromegaly controlled by pituitary hormone. Sir Arthur Keith suggests that the cases of hemihypertrophy of the jaws in children should be regarded as localized forms of acromegaly.

Hormonal disturbances could lie behind many cases of open-bite malocclusions, such as hypothyroid symptoms or tetanic symptoms. Clinton Howard demonstrated recently in a most remarkable study the close relations between hormonal changes, anatomic changes of the body and jaw morphology. (Fig. 5.) Kranz showed also cases of cretinism related to open-bite. But it must be stated that the main malformations observed in these cases have the same morphologic characters as rachitism. Moreover, the radiographic surveys demonstrated this assumption.

Parathyroid troubles can also be related to rickets and so to open-bite. The clinical picture of thyroid deficiency is as follows: retardation of growth (nanism), hair and nails very sparse, the skin is rough, the intelligence low and retarded, the osseous developments of fontanels retarded. The teeth are hypoplastic and small, the roots short, deciduous teeth remaining, and eruption of permanent teeth retarded.

Clinton Howard stated that hypogonads have a great influence on osseous and body proportions and have a direct bearing upon malocclusion. All patients presenting unmistakable hypogonadism have shown a marked disproportion in body measurements and invariably have possessed a malformation of the dental arches. We believe that an individual with a disproportion of long bones will present a malocclusion. Beyond these general causes of open-bite we must still remember faulty diet, although a clinical proof is not easily found. But animal experimentation showed the retardation of the growth of the maxilla. Percy Howe produced a definite open-bite with the monkey on a diet deficient in antiscorbutic vitamin. The lack of several vitamins is also considered responsible for many malformations due simply to retarded growth, but we cannot show a definite relation between this feeding condition and open-bite production.

Adenoids and also the enlarging of the lymphatic ring of the pharynx may in several cases be at the root of a slight opening of the bite, but the result must be regarded as a secondary malformation caused by the extreme narrowing of the arch. The narrowing of the maxillary arch particularly when the

mandibular arch is large can lead to a superelevation of the bite and cause an open-bite. We have seen that narrowing is an ordinary allied symptom of open-bite.

Besides the general factors which produced open-bite by a disturbance of general metabolism, more proximate factors may be of importance. These factors do not act on the metabolism but on the osseous structure of the maxilla by traumatism, infection or developmental malrelations. Surgical operation on the nasal cavities and on the maxillary bone may hinder the normal growth of the alveolar bone and of the permanent teeth.

Severe infections of the nasal cavity (sinusitis, rhinitis, alveolar tumors or infections, alveolar cysts [dentigerous or not], ozena) may be causes of open-bite. Nervous injuries of facial or maxillary muscles, paralysis or spastic contractions, all these causes can be cited as adjuvant causes of open-bite.

At the temporomaxillary articulation different lesions may be responsible for deficient closure (luxation, meniscal displacement, etc.). At a given time eruption of the third molar and also insertion of partial dentures, bridges, etc., can open the bite. Schwarz (Vienna) showed recently the relation between the third molar and short tooth roots resulting in an insufficient stimulation of alveolar growth.

CONCLUSIONS

This short review of the generally acknowledged causes of open-bite malocclusions leads us to draw the following conclusions.

Open-bite is the result of disharmony of the teeth and jaws and the cranial supporting structure. This disharmony can be produced by a disequilibrium of static conditions, of dynamic conditions in space or time. The factors which disturb the static conditions and also those which disturb the dynamic conditions may lead to an opening of the bite. Several causes have a background of definite clinical observations and experimental evidence, but many of them must be accepted as concomitant epiphenomena of an unknown cause.

A logical etiology needs to explain the relationship between the causes and the peculiar morphology, and it must also be able to distinguish a malformation long before it has become an abnormality. Open-bite is certainly one of the most complicated malformations we ever meet. When a clear and definite etiology has been given for the more simple malformations, the etiology of open-bite will become more explicit.

FUNCTIONAL OR DYNAMIC EFFECTS

Esthetic Consequences.—The extreme cranial and maxillary malformations of open-bite cases have a disastrous effect on the appearance of the face. Some open-bite cases have an ugly aspect, having in the most advanced cases an external aspect of hydrocephaly. The open mouth, the backward situation of the orbits and the root of the nose, the obtuse angle of the mandible, the elongated face produce a result detrimental to facial beauty.

Some cases have an appearance of exophthalmia. Lips are thick and badly musculated. The tongue shows itself between the lips during eating and speaking.

The inferior third of the face is elongated and presents the most prominent defect of facial beauty.

Mastication.—The masticatory apparatus is handicapped by the loss of masticating surface. The incisors and also in some cases the premolars and molars are useless for the trituration of food. The coefficient of mastication is very low. The aperture of the mouth is used for respiration. Many patients with open-bite are buccal breathers and have a lowered nasal permeability. Dry rhinitis is very frequent.

Speech.—The pronunciation of the consonants is rendered difficult on account of the incisor aperture. The hissing consonants are very difficult to pronounce. These inconveniences are called stigmatisms, labial or lateral according to whether the aperture is between the incisors or the molars. After a statistical investigation an orthophonist made the following statements: out of 48 cases of open-bite, 28 of them possessed stigmatism; 22 of them interdental stigmatism, the other 5 had peculiar cases of stigmatism. (Barczinski.)

Deglutition of food is inefficient; swallowing a considerable amount of air leads to erophagic troubles. The musculature of the lips and of the facial features is very weak according to the record of Sheldon Friel.

TREATMENT

Open-bite is considered one of the worst cases for orthodontic therapy; the most difficult to correct and the most uncertain. The most optimistic of orthodontists must admit that there are really incurable cases. Their treatment is a symptomatic one. Each of the practitioners makes an attempt to elucidate the symptom which he considers responsible for the case.

In a study of the different ways of treatment we can consider the different methods under the following headings:

(1) Prophylactic measures.
(2) Mechanical measures.
(3) Physiologic measures.
(4) Surgical measures.
(5) Prosthetic measures.

Prophylactic Measures.—In the endeavor to master open-bite malocclusions, prophylactic measures are certainly the most profitable ones. We shall not emphasize the value of the preventive measures against degenerative processes produced by syphilis, alcoholism, etc., because that action lies in the hands of the family physician, and because its necessity must be admitted for reasons more important than the mere prevention of malocclusion. Nevertheless we must give a little space to the cure of maternal syphilis. Attention to maternal syphilis during pregnancy can limit to a great extent the production of the most important cranial deformities and the most prominent of infantile weaknesses.

The struggle against alcoholism must be a task of persuasion.

We are more concerned in the struggle against rickets. The defensive arms are air, sunlight, adequate food. During pregnancy the mother's food must be substantial and largely provided with vitamins (fruits, vegetables).

After the birth the mother's milk is the best food for the child. When artificial food only is available, the child's food must be the subject of constant supervision. Fat children are not sound children. A serious slowness in voluntary movements, a serious delay of eruption of the deciduous teeth, of walking, are indications for active intervention. The diet must be changed, adding a few drops of liver oil, or irradiated milk or other irradiated substances, sunlight or ultraviolet rays. By these means the attacks of rickets will be easily reduced, but we must bear in mind that we do not know the real importance of these measures in regard to development. Malocclusion can occur posteriorly and is not so much caused by the rickety affection as by the processes of healing. Rachitic lesions heal by condensation, and this condensation of bone can produce malocclusion by interference with normal growth. A condensed bone has also lost an important part in its faculty of development. Methodic movements such as stimulating exercises are the only ways of doing away with these possibilities of maldevelopment. Bony lesions due to endocrine disorders can be fought by vitamins which will give a more rapid and favorable effect than opotherapic drugs whose actions will always be slow and uncertain. Intrauterine malformations are beyond our active intervention. A second most important prophylactic measure is the suppression of bad habits (thumb or finger habits, tongue- or lip-sucking). The parents must guard against the disastrous effect of finger habits. Most parents are warned against the use of dummies but do not take enough precaution against thumb-sucking. The thumb is more pernicious than the dummy because its action is stronger, less hygienic, and presents more difficulty in prevention than the dummy. The pressure exercised by the thumb is much more powerful than the slight pressure produced by a dummy.

There are many preventive measures against thumb-sucking:

(1) When the child is very young we can simply fasten the arms along the body or enclose them in the nightdress.

(2) We can disgust the child with this habit by application of substances with a bad taste (aloes, quassia amara, etc.). The child may not be aware of its influence on the psychologic process.

(3) Keep gloves on of a hard fabric.

(4) Place on the finger a finger-stall in metal or dressed metallic wire. For when the child is no longer young, he can take the gloves off. We could nevertheless use a suit with closed sleeves or sleeves with a light rubber lining. Aloes and other drugs can be put on the finger during sleep. When the child involuntarily gets his finger in the mouth, the bad taste will immediately remind him to keep his finger out of the mouth. Persuasion is perhaps still the best method. Older children can have a gummed band with or without bad-tasting drugs placed on the finger. Several authors have invented peculiar appliances to place on the fingers in order to avoid the bad habit. They are very good if the child is even-tempered. These appliances strive to prevent tolerant enjoyment of finger-sucking by hindering the introduction and the sucking motion.

Buccal appliances can be used too, which by either their form or volume prevent the finger resting comfortably in the mouth. In short, preventing

thumb-sucking is not an easy matter, especially when the habit is a diurnal one. The nightly habits are much more easy to prevent. Prevention of pressure must be emphasized as a very effective prophylactic measure against open-bite production.

Mechanical Measures.—The object of mechanical measures is to change the osseous structure either of the alveolar bone or of the maxillary bone so as to close the occlusion of the teeth. One can divide the mechanical measures into several headings.

(1) Measures aiming at producing a change in the vertical position of the maxillary or mandibular alveolar bone in the anterior regions.

(2) Measures aiming at changing the construction of the alveolar bone in the molar region.

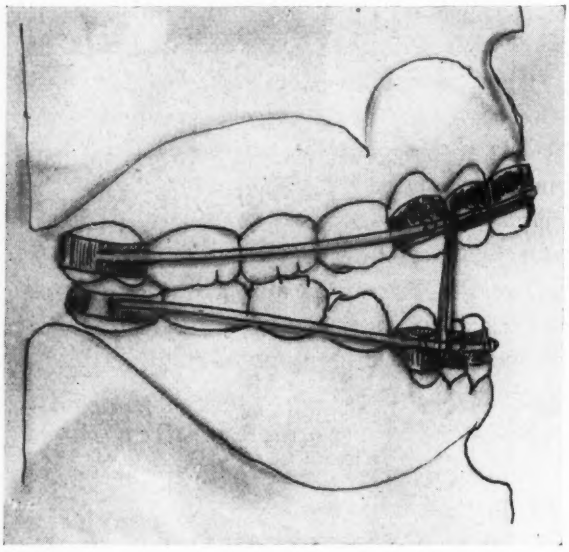

Fig. 6.

(3) Measures aiming at changing the mandibular angle or the shortening of the ascending ramus.

(1) *Measures Aiming at Changing the Anterior Alveolar Bone of Maxilla or Mandible.*—The object of these mechanical measures is to produce an extrusion of the incisors and to cause a lengthening of the alveolar bone to close the bite. The main difficulty is to find a convenient fulcrum without producing extrusion of the molars.

Angle advises the use of his arch appliance. The mandibular and maxillary arches are supplied with bands on the first molars. The arch is lying under the level of the incisors and above this level at the mandible. The incisor teeth are attached to the arch producing a flexion so as to bring the attached arch to the same level. The curved arch will produce a verticle reaction or tend to straighten its level. The molars must support this twofold reaction. In order to ensure the safety of the molar teeth Angle advises a slow and not a

too powerful action. Rest periods are arranged between periods of pull to relieve the alveolar bone and to prevent it following the extrusion of the incisors.

When the arch is narrow Angle advises making the expansion without interfering with the open-bite. In several cases he slightly grinds the masticating plane of the molars, but only at the end of the previous operation. He states that open-bite cases are the most difficult we can meet with.

Case uses a maxillary and mandibular arch with incisor bands and intermaxillary elastic between maxillary and mandibular incisors. (Fig. 6.)

Dewey does not make a special statement upon the treatment of these cases. Ketcham was recently much occupied with open-bite treatment. He uses either the Angle technic and the Angle arch with the simple expansion arch or the pin-and-tube appliance combined with elastic rubber traction on the incisors in order to relieve the molars. The forces used are the torsional force of the recurved arch and also the force of elastic rubber rings with reciprocal anchorage. Several authors advised other types of appliances. We can mention the appliance of Richardson, formed of an expension arch with loop springs attached to the incisors on the anterior part.

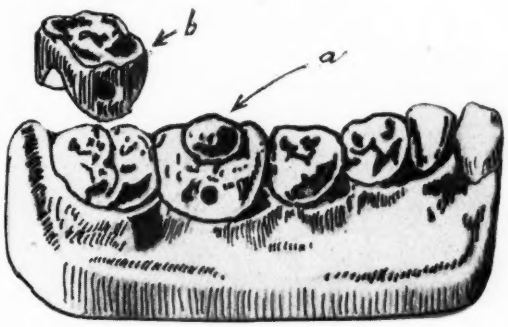

Fig. 7.—Leonard's silver shell in order to depress molars.

De Nevreze constructed a similar arch of stainless steel. Schwarz constructed an appliance with a closed auxiliary spring at both ends which must give good results.

The unfortunate feature of all these appliances is that they burden heavily the anchorage molars and can misplace them. It is for this reason that intermaxillary traction is not generally favored. The teeth may be unable to resist the pressure without injury, and there is in many cases a difficulty in enforcing the wearing of elastics. The edgewise arch can also be used for the correction of open-bite, and Kelly demonstrated a very beautiful result. Stainless steel is sufficiently elastic to depress anterior teeth by arch elasticity only and without the use of elastics.

Recently we have used a steel arch in two parts: a posterior part with two bands on the molars and premolars with a hard wire soldered between them. On the wire a small spring is soldered which will depress the incisors. This appliance constitutes a very stable anchorage, and the spring in the anterior part is very effective. Another method is to use a long weak wire. A small wire like a Schwarz spring is soldered on to the heavy wire at the two ends and

is hooked on the incisor bands. Lateral loops are provided on the heavy wire. Activation of the spring is done by pinching a loop in the heavy wire between the ends of the small wire while the lateral loops are slowly flattened. The same wire can be soldered to a plate in order not to interfere with the molars.

(2) *Measures Bearing on the Posterior Part of the Arch.*—The first measure was the grinding of the molars to a lower level so as to permit the anterior teeth to come into occlusion. In some cases the grinding of the molars needs to be very extensive and the devitalization of the teeth must be reckoned with. Sometimes extraction of the tooth which is an obstacle to the closure of the bite is to be advised. Leonard of Baltimore described the method of depressing the molar teeth by overlays on the molars. (Fig. 7.) A silver granule soldered to the top of a silver shell adapted to the molar teeth will raise the bite, forcing the masseter group muscles to exaggerate their stress; if effective, the molars will be depressed, and when we take off the appliances the bite is closed.

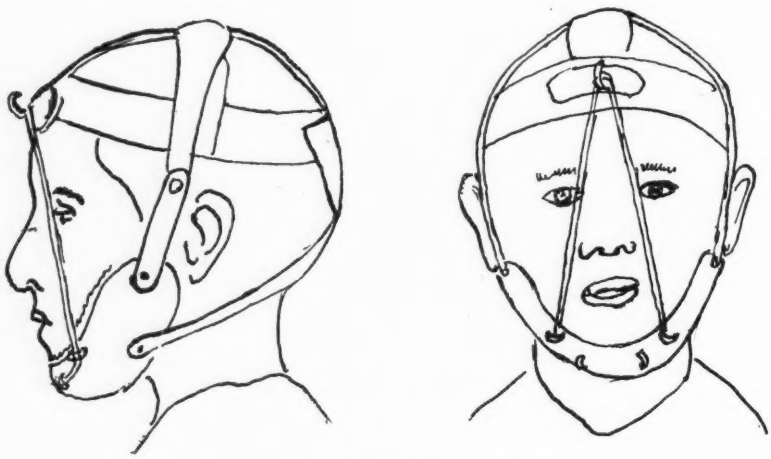

Fig. 8.—Lind's external appliance.

The mechanical depression of the molars seems to be an almost impossible feat. A plate bearing incisor depressing springs and intermolar pattern could at the same time depress molars and depress incisors.

(3) *Measures Tending to Change the Obliquity of the Mandibular Angle.*—Previously mentioned methods have not changed the obliquity of the mandibular angle. Certain methods have as their object the changing of this obliquity by mechanical means in order to bring the maxillary and mandibular arches closer. The first means was the use of an occipital anchorage pulling a chin piece. It needs no discussion to admit that the pressure of such appliances can depress the mandibular angle at an early age. Cadenat of Toulouse, and also Clinton Howard have shown the action of plaster orthopedic apparatus on the chin and the angle to produce suroclusion. Lind (Amsterdam) constructed a more perfected apparatus in order to depress the angle and to bring the maxillary and mandibular teeth closer. A plaster apparatus similar to the orthopedic ones would perhaps be of the same value. (Fig. 8.)

Physiologic Measures.—It is a fact that in the correction of even so severe a deformity as the open-bite great value must be attached to the effect of normal physiologic reactions. Some of the mechanical methods have used physiologic excitation. The simpler cases may sometimes correct themselves merely after leaving off the bad habits. Milo Hellmann found by examination of his own cases, treated and untreated, that the same percentage of the cases was corrected by natural physiologic intervention as by mechanical.

How can spontaneous correction be encouraged? Artificial openings of the bite in the deciduous dentition can relieve themselves after shedding of the deciduous teeth. The loss of deciduous molars can depress the bite. When the permanent molars erupt, they cannot grow to their natural level and remain on a lower level, closing the bite. On the other hand, some habits may increase the normal muscular strength, and may allow the pressure of the masseter to

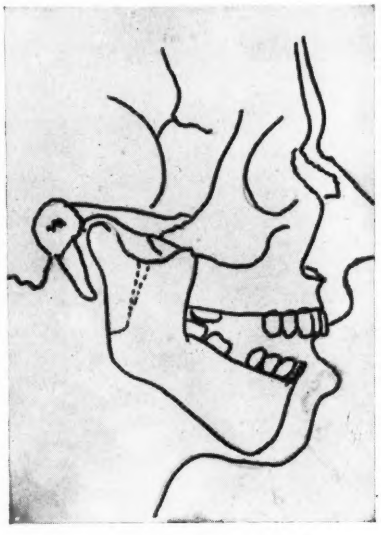

Fig. 9 *A.*

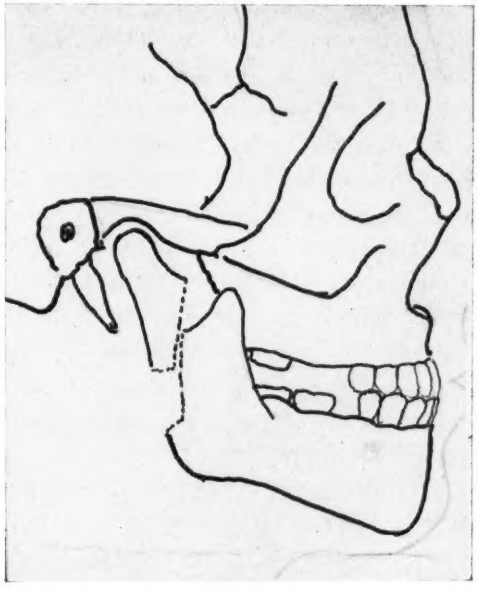

Fig. 9 *B.*

depress the molars. Excitation of this masseter contraction may be an efficient method of depressing the molar teeth and closing the bite. The rubber thumb invented by Ellis can in such cases be of great value. Quintin (Brussels) had advised mastication of chewing gum to strengthen the masseters. Izard (Paris) described a plate appliance with intermolar pattern to depress molars in their alveolus.

Surgical Methods.—The most severe cases are often beyond the limits of orthodontic intervention either because of their complication or because the patient is too old. On account of the great inconvenience for personal reasons of an ugly open-bite face, surgical intervention can be advised. The majority of surgeons operate on the mandible by osteotomy either of the vertical ramus, like Limberg, or of the condyle, like Dufourmentel. The osteotomy of the mandibular angle, cuneiform excision of the angulomandibular region or cuneiform

excision of the horizontal branch were advised. Cohn Stock was the only one who made an operation on the maxilla. (Fig. 9 *A* and *B*.)

Prosthetic Means.—There are several cases which are beyond the aid of orthodontia and also surgery. Prosthesis can in such cases repair and reconstruct artificially the normal situation. Chenet (Paris) showed a few years ago several reconstruction cases. It was an overlapping construction. The opening of the bite was filled with artificial teeth fixed on the natural teeth.

GENERAL CONCLUSIONS

Open-bite occupies a particular place among the vertical displacements. Regarded by the first authors as a separate malformation, open-bite must be envisaged as a possible final result of a great number of facial, maxillary, and dental abnormalities. In the less severe cases the opening of the bite constitutes the main symptom. Before entering on the problem of the etiologic factors we have to study the various morphologic forms of the anomaly in order to classify and adjust the etiologic findings in a definite form. We have seen that the opening of the bite can be produced by a great many static and dynamic disturbances. As it is found in company with morphogenetic deviations of the skull, with localized lesions of the maxilla, the mandible (chin, horizontal ramus, vertical ramus, angle or condyle) and of the alveolar processes, the elucidation of the meaning of open-bite symptoms is really very complicated, especially when combined with muscular troubles and functional disturbances. The etiologic factors, although known in outline are not very definite evidence, and we cannot state the exact cause of a given morphologic situation. All that we dare say is that open-bite results from disorder in the succession of growth processes of the skull and the face, produced either by trouble in the static relations, or in the chronologic succession of the growth phenomena, or by external pressures upon a tender or young bone. Rickets, hormonal factors, and external pressures are the only factors the evidence of which is clear.

We must distinguish in practice open-bite anomalies produced by external factors and morphologic situations due to some generalized trouble in the basal metabolism. Treatment of the first type is a relatively easy matter; the second type is scarcely curable. The proposed methods can be placed in the following categories: prophylactic, mechanical, physiologic, surgical and prosthetic measures. Thus we see that the most severe of all the morphologic anomalies that we meet needs also an extraordinarily complete therapeutic armory.

Department of Oral Surgery

Edited by

ROBERT H. IVY AND KURT H. THOMA

Articles on oral surgery, radiography, and anesthesia should be submitted to Dr. Robert H. Ivy, 1930 Chestnut St., Philadelphia, Pa. Articles on oral pathology should be submitted to Dr. Kurt H. Thoma, 47 Bay State Road, Boston, Mass.

CHEILOPLASTY FOR CANCER OF THE LIP

EARL C. PADGETT,* M.D., KANSAS CITY, MO.

TO FACILITATE description, in this article only the surgical treatment of the local lesion of oral cancer will be discussed. The care of the lymphatic areas to which the local lesion drains is as important a consideration as the care of the local lesion. The discussion of their care is reserved for a separate article of this series.

The ideal operative procedure whenever it is attainable is eradication of the local lesion and the tributary lymphatic areas at the same time. In the practical application of this ideal principle, however, it may be found that the operative mortality is increased to a greater extent when a one-stage operation is done than the increase in the number of final cures justifies. In such a situation a two-stage operation is the wiser procedure.

In this article a brief discussion is given of useful reparative operations after excision of varying widths of the lower lip. Operations based upon the same principle would be applicable to the upper lip if it should be the one needing excision.

The statement has been made that surgery has no place in the treatment of the small or moderate sized lesion of the lip but that extensive surgical excision of the lower lip with plastic closure should be resorted to in the bulky fungating and infected tumors which are sometimes found after neglect. The statement has also been made that v-shaped excision should never be used as the primary treatment. Although we own and use radium, for the small lesions of the lip we do occasionally perform a v-shaped excision and consider that when properly done radium can in no way show a superior result. It has also been stated that in neglected massive growths where much normal tissue has been destroyed or is replaced with tumor tissue, destruction of the disease by irradiation and later plastic repair are the safest procedure, and that the difficulty of plastic surgery in irradiatied tissue has been overemphasized. In the former situation we believe wide operative removal or destruction is

*From the Department of Oral Surgery, Kansas City Western Dental College, Kansas City, Missouri, and the Department of Surgery, University of Kansas School of Medicine, Kansas City, Kansas.

This is the seventh article of a series upon the subject of malignancy in and about the oral cavity. All phases of the subject are to be included.

the better and more effective procedure. In the latter situation any one who has tried to repair a defect cannot help but realize that without interference with the blood supply of the soft tissue which either will have to be transplanted or will have to unite with other flaps this type of surgery is tedious enough without adding anything to a procedure difficult at best.

The operative procedures described have all been used repeatedly in my own cases and in my hands have proved their value.

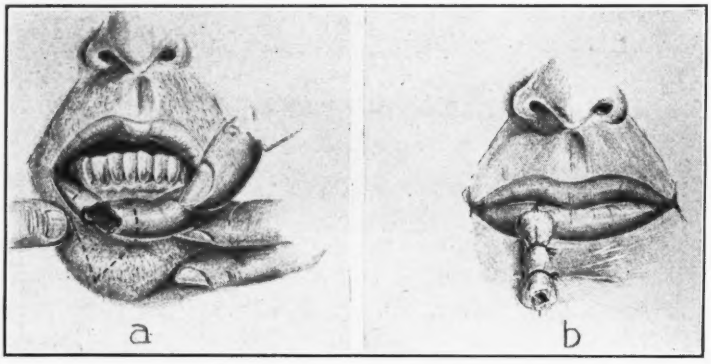

Fig. 1.—*a*, V-shaped excision of the lip.
b, Diagram showing method of stitching a small gauze roll over the lip.

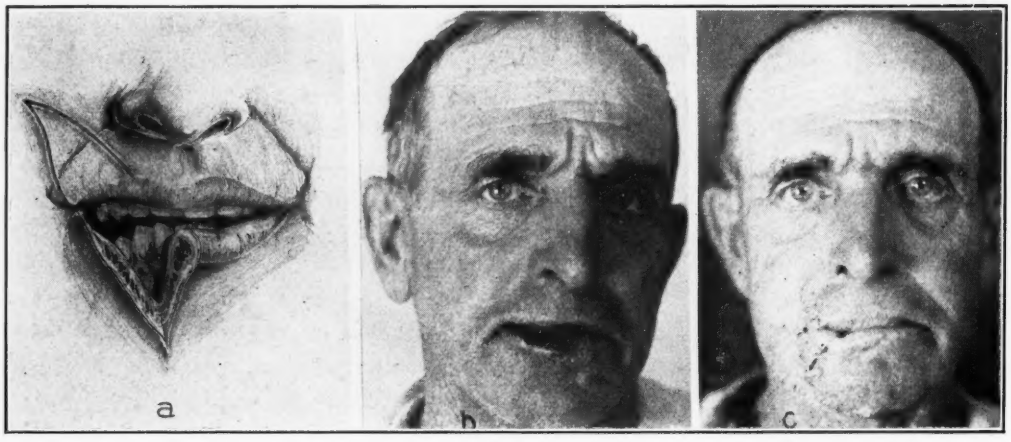

Fig. 2.—*a*, Diagram of amount of tissue excised and the amount of flap outlined in the upper lip for repair after wide excision of from one-half to one-third the lower lip.
b and *c*, Photograph of patient before and after the operation shown diagrammatically in *a*.

THE LIP

(*a*) *V-shaped Excision.*—For the small epitheliomatous ulcer, excision gives eradication of the disease locally in over 95 per cent of the cases (Fig. 1a). With proper plastic repair, which is not difficult, there remains only a vertical hairline scar in the lip. The excision can be done under local anesthesia and does not necessarily have to be done in an operating room. It can be done in the office. The patient need not be confined to bed, and after a few days he may go about his ordinary work. A microscopic study of the whole of the dis-

ease can be made. The incision lines to either side of the growth should be from ¾ centimeter to 1 centimeter away from any sign of the disease. The incision cross cuts all layers of the lip. The coronary artery when cut is tied with fine silk or catgut. From the inside, sutures of catgut or silk are used for the mucosa and taken rather deeply so that deep approximation of the

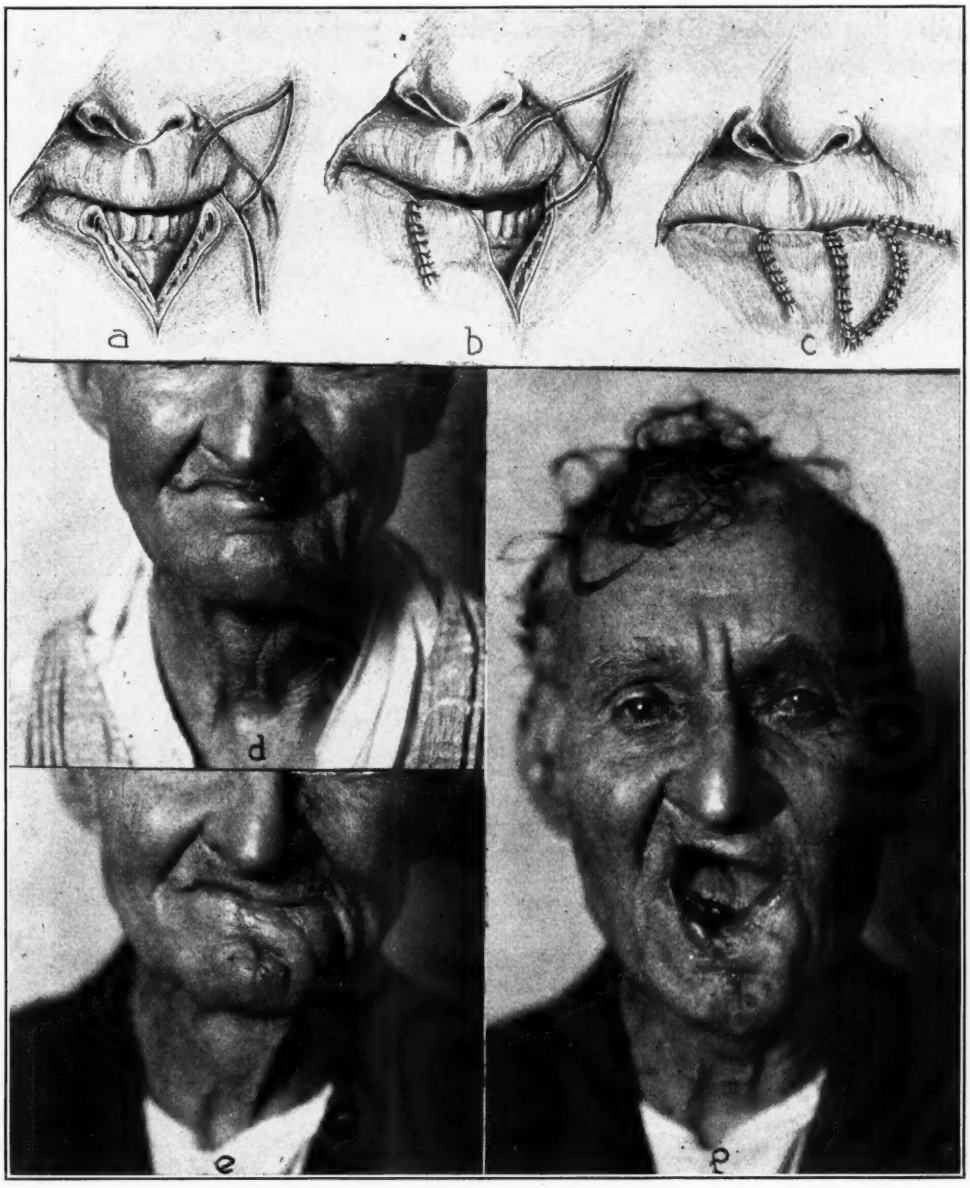

Fig. 3.—*a*, Diagram showing amount of tissue excised.

b and *c*, Diagrams of appearance of the lip and mouth after the outer part of the lip has been brought to the midline to form the central part of the lower lip, and (*c*) the upper lip has been turned down to fill in the outer lower lip defect. Each flap is sutured as described in the text.

d, *e*, *f*, Photographs of patient before and after the operation shown diagrammatically in *a*, *b*, *c*.

tissues is obtained. On the skin, fine silk or horsehair interrupted sutures are used, and careful approximation of the skin is obtained. A small gauze dressing

may be sewed over the lip (Fig. 1b). This is removed in two days. The skin sutures are removed after five or six days. This procedure tightens the lower lip slightly but usually about 2 centimeters or even more of tissue can be removed in this manner without this being noticeable.

(*b*) *V-shaped Excision With Transplantation of a Flap From the Upper Lip.*—When it is necessary to remove from ⅓ to ½ of the lower lip, it will be found that the lower lip is too tight if some additional material is not thrown into the lower lip. Estlander in 1877 described the principles of an operation which is very applicable. A v-shaped excision may be done as described above. To fill the defect a similar flap is outlined at the outer border of the corresponding upper lip (Fig. 2) and excised in toto save for the narrow piece of tissue in which the coronary artery of the lip is located. The artery is left intact at the median corner of the flap. As the coronary artery is only about ⅛ inch from the border of the lip, practically all of the triangular piece of

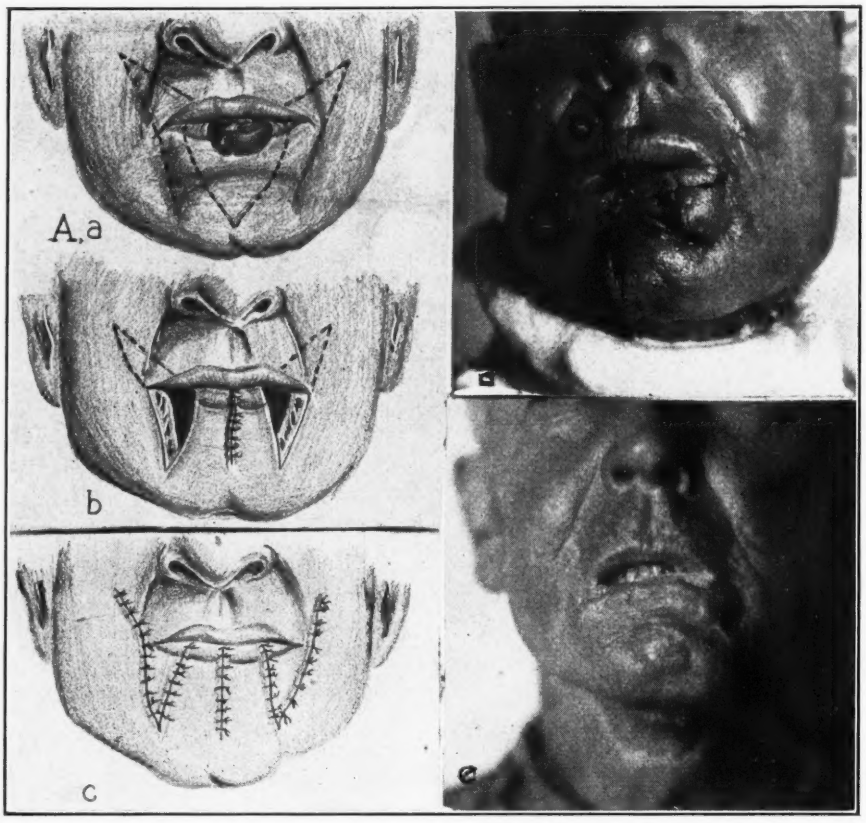

Fig. 4.—Diagrams of method of repairing immediately the lower lip at one sitting after about three-fourths of the lip has been excised.

a, Lower lip shows amount excised. Upper lip shows outline of the two flaps which are to be thrown into the lower lip defect.

b, Edges of the lower lip have been brought to the midline, but the upper lip flaps have not been thrown down.

c, Diagram of the lip and mouth after the flaps have been sutured into their proper position.

d, Photograph of patient in whom this operation was done and from whom at least three-fourths of the lower lip was excised—ten days after operation. A neck dissection was done.

e, Same patient six months after operation. Note scar of collar incision of neck dissection.

upper lip is separated. The coronary artery will give a good blood supply when it is not injured. This upper triangle of lip is made about one-half the size of the triangle excised from the lower lip. All layers of lip are cut through. More mucosa than skin may be cut out if the lining of the lower lip appears likely to be inadequate. The upper triangle is then turned down into the lower lip and sutured as described under v-shaped excision. An additional tension suture is used to hold the cheek firmly to the upper lip, but it is placed in such a manner that the coronary artery which feeds the flap is not injured or constricted. The cheek may have to be reshaped to make the whole fit well. A very good appearing mouth and lip can be obtained by this procedure, and the scar is very slight. When the corner of the mouth is a little too near the midline, about twelve days later it can be extended out to the proper point by a simple outward incision. A few stitches are used to draw

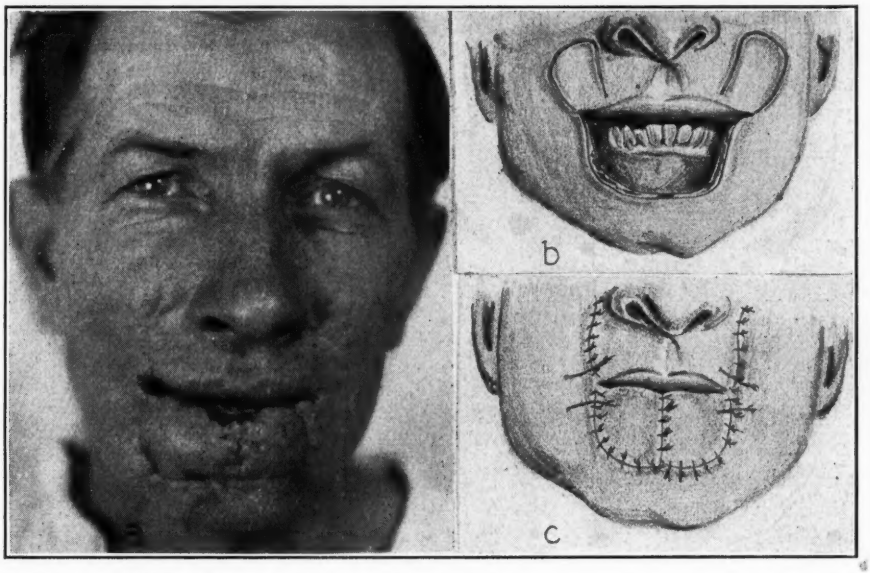

Fig. 5.—*a*, Photograph of a man after having a flap from each upper lip and outer cheek thrown down to build a complete lower lip without any interposition of the flap at the corner of the mouth. In this man practically all the lower lip was removed and repaired at one operation. This photograph was taken eighteen days after the operation before the scars had had time to thin out and the lip still looks a little thick. After six or eight months' time it would be much smoother than at the time the photograph was taken. The angle of the mouth was cut outward about four days before the photograph was taken.

b, Diagram showing the outlining of a flap on the upper lip after the damaged tissue in the lower lip has been removed.

c, Diagram showing manner in which the flap is thrown down to the lower lip and sewed in place. The deep sutures for the approximation of the deep tissue are taken from the inside presumably, and it is very important that the deep tissue be approximated.

the mucosa to the skin at the corner. The operation is done under local anesthesia as a rule, and the patient does not necessarily have to remain in the hospital more than a few days.

In Fig. 3 is shown a modification of the method of applying the principle of using an upper lip and cheek flap to aid in rebuilding the lower lip. In this second method the outer part of the lower lip is thrown toward the center of the lip to build the central part of the lip. The upper lip flap is used to build the outer corner. When the lesion on the lip is near the midline, this may be applicable.

(c) *Excision Which Removes About Three-Fourths of the Lower Lip.*—In case at least three-fourths of the lower lip has to be removed, one flap from the upper lip will not suffice to make a lower lip of sufficient width for good function. In several cases we have performed the following procedure (Fig. 4) which is only an extension of the preceding principle. By the use of this method in one operation a good lower lip can be built, which will appear well and function well. To build the central part of the lip the one-fourth inch or so of lower lip left at either side is thrown to the midline. Then a flap is outlined at either extremity of the upper lip on both sides. The coronary artery in our cases has given sufficient blood supply for both flaps. Both of the upper lip flaps or triangles of tissue are now thrown down into the lower lip region to form the outer part of both sides of the lower lip. Both the inner mucosa and the deep tissues and the skin are carefully sutured. After the operation the mouth is somewhat narrowed but after the induration disappears, it will be found to stretch considerably. When too narrow, the mouth can be widened at the angles by an outward extension incision any time after about two weeks. This procedure has the advantage of allowing one to build a satisfactory almost complete lower lip in one operation. The operation is not very difficult to perform. It may be done under local anesthesia.

With this procedure almost a complete lower lip can be built (Fig. 5). When little or no part of the lower lip remains at the mouth angles, practically the whole of the lower lip may be built by bringing the two triangular upper lip and cheek flaps down so that the two flaps are united, one with the other, in the midline without the interposition of any of the remaining lip as described in the preceding procedure.

(*d*) *Complete Removal of Chin and Lower Lip Area and Repair.*—When it is necessary completely to remove the lower lip, soft tissues of the chin and possibly a part of the cheek, often it is also necessary to cauterize the front part of the mandible because as a rule the periosteum or even the bone is found to be invaded (Fig. 6). The coagulating diathermic current or the soldering iron as preferred is used to kill a part or nearly the whole thickness of the front of the mandible. After about two months the dead bone will have sequestrated, and separated. The sequestrum is removed by simply pulling the dead bone off with some instrument of the rongeur type, if it does not fall off by itself. Usually one should wait from six months to a year after the primary operation before starting to rebuild the lower lip to see whether there is going to be an early recurrence. There is no reason for putting the patient through such extensive reparative procedure until one is reasonably sure that local recurrences are unlikely. The lower lip is then built by using a flap of skin from the neck which has little or no hair on the part to be used, and a flap from the scalp which may have advantageously a good growth of hair. The neck flap is used for the inner lining. The scalp flap is used for the outer covering. The neck flap is tubed about two weeks before it is planned to transplant it and the scalp is outlined and resutured in place at the same time. After two weeks the flaps are thrown into their respective positions and are well sutured. About three weeks will elapse before a sufficient blood supply is obtained so that the flaps can be cross cut and sutured in position on the

opposite side of the mouth. The pedicles of the flaps at this time are sutured back into their former positions. In the area from which the scalp flap is removed, a full thickness skin graft from the abdomen is sutured at the time the scalp flap was thrown down to the lower lip region. On the neck the skin is drawn together beneath the tubed flap at the time the neck flap is tubed. Later the scar line on the neck is reopened partially and the pedicle of the flap resutured into its former position.

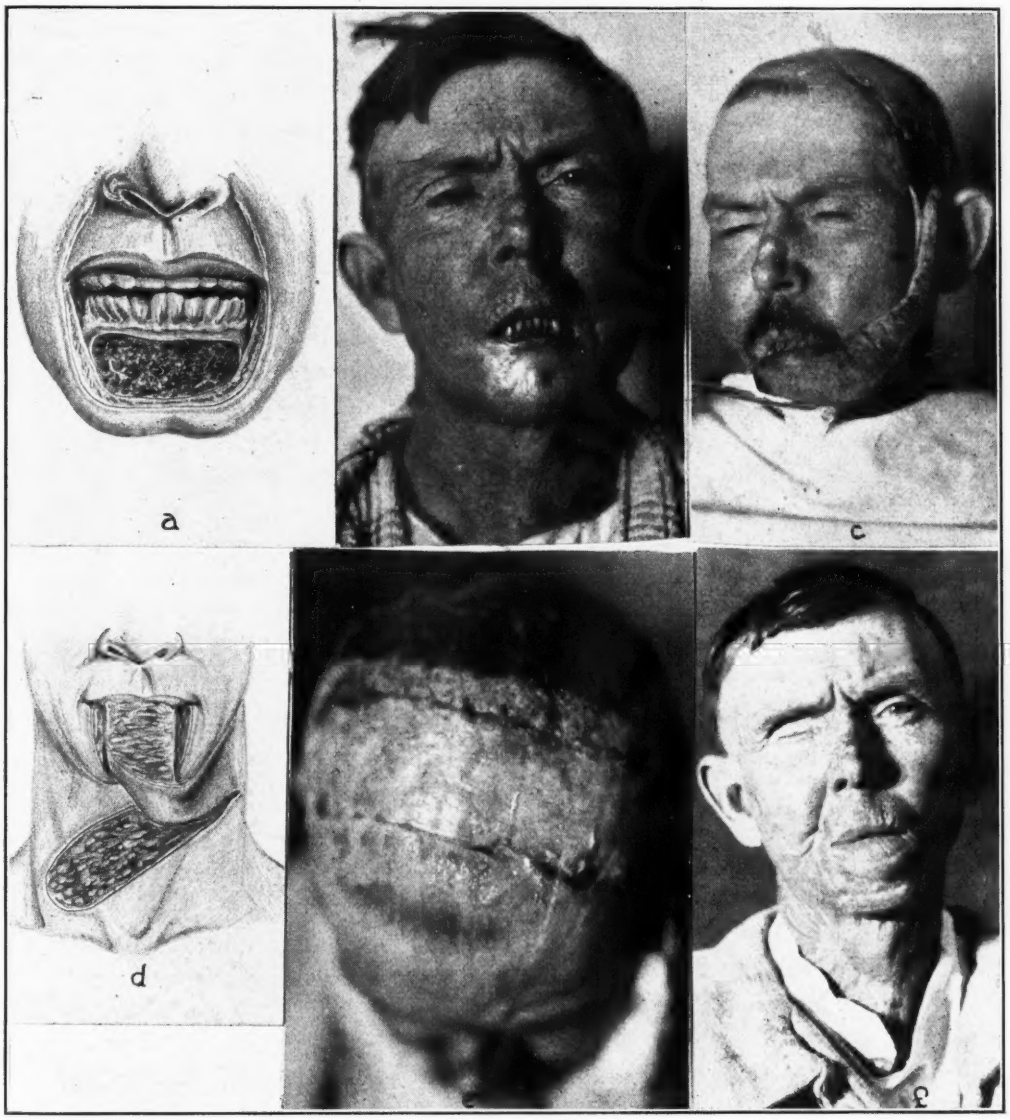

Fig. 6.—*a*, Diagram after complete removal of the lower lip with thorough cauterization of the anterior part of the mandible.

b, Photograph of a patient on whom cauterization was done a year after the sequestration had been removed and the chin has scarred over. The teeth ordinarily would have been removed or have been a part of the sequestrum. In this case the cauterization was done elsewhere eighteen months before the photograph was taken.

c, Photograph of procedure when the scalp flap is thrown down to the chin. A full thickness skin graft from the abdomen has been thrown into the defect.

d, Diagram of method of turning the flap from the neck behind the scalp flap to reline the lower lip.

e, Photograph of full thickness graft placed over the scalp defect after three weeks.

f, Photograph of patient six months after rebuilding of the whole lower lip and chin region.

To imitate the vermilion border of the lower lip, the neck flap must needs be turned so that a sufficient amount shows along the upper border of the new lip. The hair of the scalp prevents it from being used for this purpose. As the new part of the lip has no sphincter muscle, it will sag in the center if it is not drawn very tightly from cheek to cheek. As a rule, after a period of several months because of softening and stretching of the new tissues, some of the new lip has to be excised to make this tightening more complete. Although this operation is a large one, it should go from step to step without any mishap. It gives a satisfactory lip. If one wants to be a little fancy, mucosa from the cheek can be thrown over the upper edge of the lower lip to imitate the normal vermilion border of the lip. This little trick is not so easy as it might appear, as a rule. It is difficult to get the mucosal flaps long enough, and at the same time to preserve their blood supply at the distal ends. With care, it can be done, however; but the flaps may have to be either delayed or tubed before final transplantation to the lip.

CONCLUSION

In conclusion it may be pointed out that cheiloplasty for cancer chronologically is one of the oldest operations. Celsus (born about 25 B. C.) refers to the operation. During the first half of the nineteenth century many more or less classical methods were developed. In 1859 Von Bruns described 32 methods by 52 authors (Martin). Bernard, Burrows and Saemann in 1853 described an operation in which full thickness triangles are excised from the upper lip itself and discarded. The upper lip was narrowed thereby. The main part of the lower lip was then built by loosening and pulling the sides of the cheeks to the midline over the mandible. Stewart in 1910 modified this operation, and today it goes under the name of the Burrows-Stewart operation. Usually the operation gives a very tight lower lip, and the appearance as a rule is nothing to get excited about to say the least.

In 1932 Martin described a further modification of this procedure which would appear to have the defect also of being likely to give a rather tight lower lip.

The operation of using two flaps from the upper lip to build the greater part or even the whole of the lower lip has several advantages. To me it has seemed the simplest method. No tissue is thrown away. A good lining is given. The vermilion border is a normal one. The first time the operation was done, the question of blood supply to the flaps was considered. No difficulty from this source has so far arisen. The operation depicted in which a neck flap and a scalp flap are used is necessary for repair when the destruction has been greater than the whole of the lip.

REFERENCES QUOTED IN TEXT

1. Bernard, Camille: Cancer de la levre inferieure opere par un procede nouveau, Bull. Soc. de chir. de Par. **3**: 357, 1853.
2. Burrows: Quoted by Blair, V. P.: Surgery and Diseases of the Mouth and Jaws, ed. 2, St. Louis, 1916, The C. V. Mosby Co.
—: Quoted by Martin, Hayes E: Cheiloplasty for Advanced Carcinoma of the Lip, Surg. Gynec. Obst. **54**: 914, 1932.
3. Celsus: Quoted by Martin.

4. Estlander, J. A.: Methode d'autoplastie de la joue ou d'une levre par un lambeau emprunte a l'autre levre, Rev. men., med. & chir. **1**: 344, 1877.
5. Martin, Hayes E.: Cheiloplasty for Advanced Carcinoma of the Lip, Surg. Gynec. Obst. **54**: 914, 1932.
6. Saemann, O.: Die Transplantations—Methode des Hrn. Prof. Dr. Burow, Deutsche Klin. **20**: 221, 1853.
7. Stewart, J.: The Radical Treatment of Epithelioma of the Lip, J. A. M. A. **54**: 175, 1910.
8. Von Bruns, V.: Handb. d. prakt. Chir. p. 694, Tuebingen, Laupp, 1859.

SUPPLEMENTARY REFERENCES

1. Blair, V. P.: Surgery and Diseases of the Mouth and Jaws, ed. 2, St. Louis, 1916, The C. V. Mosby Co.
2. Desgranges: Memoire sur un nouveau procede de cheiloplastie, Gaz. Hebd. de méd. **1**: 956, 1854.
3. Labat, G.: Regional Anaesthesia, Philadelphia, 1924, W. B. Saunders Co.

CANCER OF THE LIP, TONGUE, AND MOUTH

I. The Lip*

Harry F. Friedman,† M.D., Boston, Mass.

CANCER of the lip is chiefly a disease of middle life or beyond, occasionally seen in young adults, and more common in the male. In the last decade there has been a definite increase in the number of cases among females. The cause of cancer in this location is undetermined as in other locations, a definite group of cases following seborrheic keratosis. Many cases are clearly traceable to the irritation of a pipe or cigar, the tumor developing at the site of the irritation. Many forms of trauma precede the development of the disease; for example, simple scratches, insect stings, and erosion by teeth. A mere fissure or crack in the lip may be the forerunner of a cancer. Cases are seen in which no known preexisting lesion is present. Leucoplakia has long been held to a precancerous lesion. Chronic irritation from any cause whatsoever in a cancer susceptible individual may, if not eradicated, lead to the development of a cancer. The proportion of cases of cancer developing in individuals on the basis of chronic irritation is not high. In any event, the opinion may be expressed that cancer develops as cancer and not as a precancerous lesion in the sense that one may have a benign neoplasm which, if left alone, will undergo malignant degeneration.

There is a great difference of opinion among oncologists as to the status of the precancerous state. Many, including myself, feel that cancer always begins as cancer. Exceptions may be cited in the development of malignancy in a pigmented mole which has been present for many years. A contra-example would be the incidence of cancer of the breast in women who have had long-standing, chronic, cystic mastitis. The incidence of cancer here is no higher than that in women with normal breasts. Pigmented moles are probably the most common of skin tumors; yet malignant melanomas form a small percentage of cancers.

DIAGNOSIS

The diagnosis of early carcinoma of the lip is sometimes difficult. The small superficial epithelioma which appears as a small nonindurated erosion, a tiny crust, or hyperkeratosis offers considerable difficulty clinically, and the true nature of this can often be determined only after biopsy. The most usual forms encountered are: (1) the papillary and (2) the ulcerative infiltrating.

The papillary form appears as a horny thickening which spreads slowly on the surface of the lip, is slow to infiltrate the deeper tissues and invade the lymph nodes. It may eventually ulcerate and follow the course of the ulcerative infiltrating type. The papillary form is a slow-growing tumor of a low order of malignancy, and responds readily to conservative treatment.

*This is the first of three articles dealing with cancer of the lip, tongue, and mouth.
†Director of the Tumor Clinic, Beth Israel Hospital.

The ulcerative infiltrating carcinoma may begin as a thickening of the epithelium of the lip, or may first appear as a nodular subepithelial mass. It ulcerates early, producing a deep infiltrating ulcer with pearly indurated edges. Associated with this type of lesion is considerable inflammation, and it is often difficult to determine the extent of the neoplasm. Extension may take place along the floor of the mouth with involvement of the periosteum of the mandible and early extension through the lymphatics to the submental, lingual, and maxillary nodes.

The tumor cells (Ewing[1]) may retain the type of adult squamous epithelium (acanthoma), or they may lose these characteristics and appear in anastomosing columns of opaque, granular, polyhedral cells.

BIOPSY

Histologic confirmation of the clinical diagnosis of cancer of the lip should always be made, regardless of whether the treatment is to be surgery or radiation.

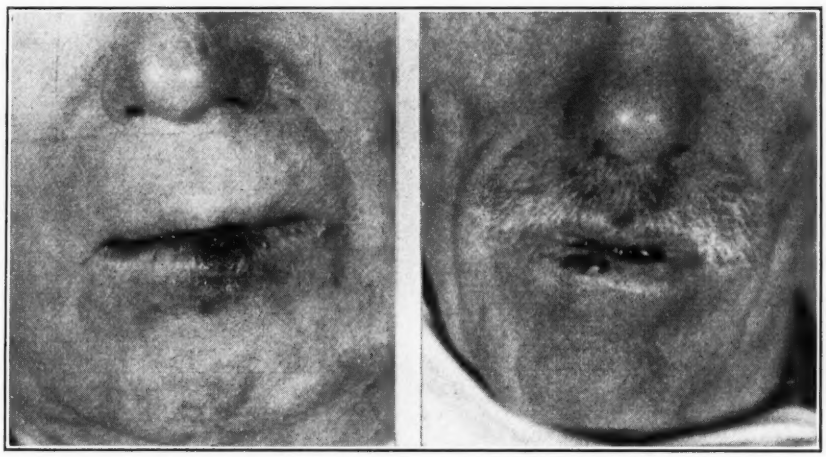

Fig. 1. Fig. 2.

Fig. 1.—Squamous cell carcinoma of the lip. Noninfiltrating type with superficial ulceration.

Fig. 2.—Squamous cell carcinoma of the lip. Papillary type.

For this purpose small, sharp-pointed eye scissors may be used. The area from which the specimen is obtained is immediately coagulated by means of a coagulating electric current. A specimen 2 mm. in thickness is sufficient. When the cancer has extended to the cervical lymph nodes, I always attempt to obtain histologic verification of their malignant nature by aspiration biopsy. For this purpose I follow the technic of Martin and Ellis,[2] using an eighteen gauge needle and a 50 c.c. Luer syringe. I have found this procedure very satisfactory. If one obtains negative findings for cancer from a satisfactory specimen, the probabilities are that one is dealing with a hyperplastic lymph node. In all cases of actual or suspected cancer of the lip, syphilis should be excluded by serologic examinations.

TREATMENT

For many years a certain relationship has been known to exist between the histologic structure of a given tumor and its behavior under radiation. This

relationship does not apply necessarily to all varieties of malignant disease or to similar types of tumors under different anatomic settings. Similar tumors in similar anatomic settings may behave differently in different individuals. Metastases from a tumor do not necessarily exhibit the same radiosensi-

Fig. 3.—Squamous cell carcinoma of the lip, moderately infiltrating.

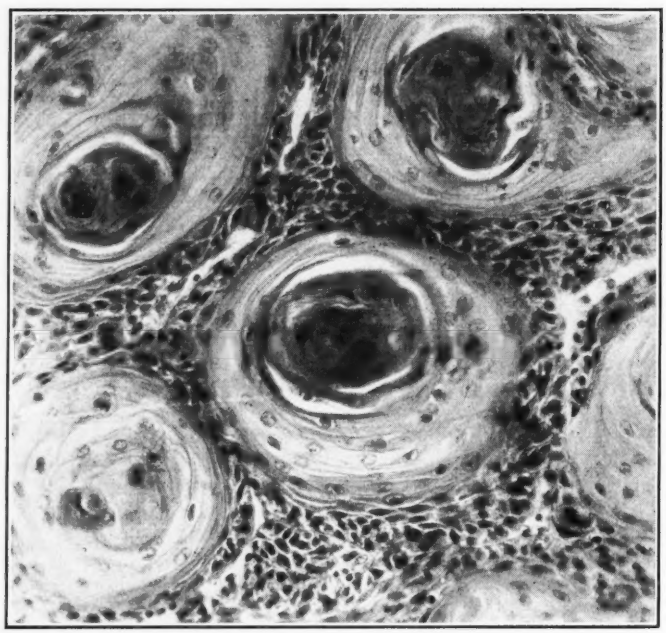

Fig. 4.—Photomicrograph of lesion shown in Fig. 3. Squamous cell carcinoma, many pearls, high degree of differentiation.

tivity as does the primary growth. The behavior of a tumor under irradiation depends upon the fundamental nature (tissue of origin) of the tumor, its location, its cellularity, its degree of anaplasia, its vascularity, its degree of papillary character, the nature of the tumor bed, the presence or absence of infection, and the general condition of the host.

Tumors of different fundamental types have individual peculiarities of behavior. Irradiation today is not a haphazard procedure. Differences in tumor behavior under irradiation are known for many tumors. Martin and Quimby[3] were the first to calculate the dose received by a tumor over a known period of time, an important step in radiology since it has enabled us to plan beforehand

Fig. 5.—Ulcerative infiltrating squamous cell carcinoma of mucosa of lip. Basal cell carcinoma of skin of lip. Two distinct tumors of lip are rare.

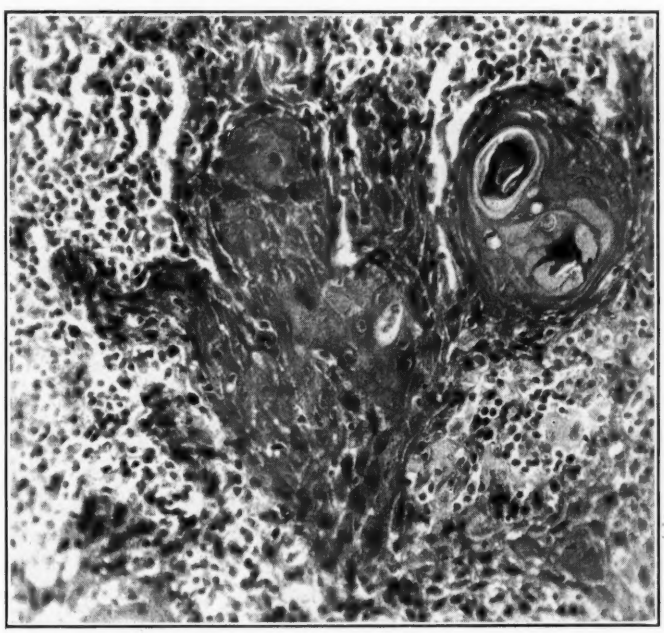

Fig. 6.—Photomicrograph of lesion shown in Fig. 5. Squamous cell carcinoma of lip, moderate degree of differentiation.

a schedule of treatment based upon the histology and clinical setting of a given tumor, much as one would calculate the quantity of digitalis necessary to digitalize a patient of a certain weight.

The most successful treatment of cancer of the lip—as of cancer elsewhere in the body—consists of surgery, radiation, or a combination of both. For the past

six years we have used only radiation, in the form of either x-rays or radium. We feel that the cosmetic results are superior following radiation and that the final result is equally as good. The percentage of five-year cures is much higher

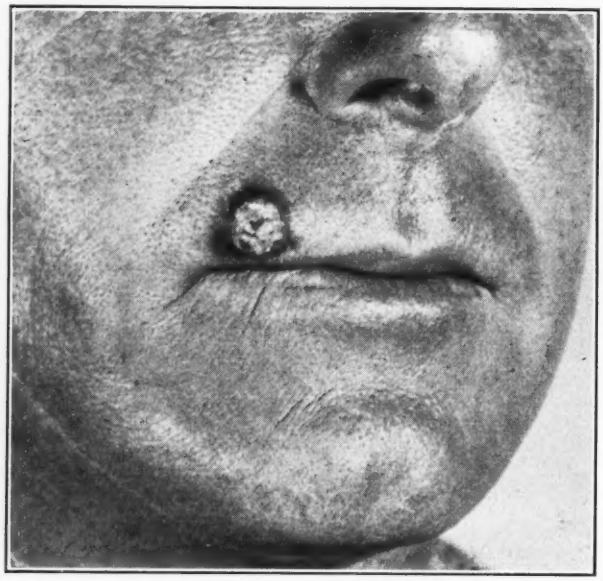

Fig. 7.—Basal cell carcinoma of the skin of upper lip.

A. *B.*

Fig. 8.—Squamous cell carcinoma of upper and lower lip. Ulcerative, moderately infiltrating. *A*, Before irradiation; *B*, following 4000 roentgens of low voltage radiation. No evidence of disease six years after treatment.

in the anaplastic tumors following radiation. For large bulky tumors a combination of surgery and radiation is best, the latter being administered in the form of x-rays and radium. In the last few years we have used roentgen rays almost exclusively in the treatment of lip cancer.

For small lesions up to 1 cm. in diameter and not over 5 mm. in thickness we use low voltage x-rays unfiltrated, 4 milliamperes of tube current, 110 kilovolts, quantity 240 roentgens per minute, giving from 2,400 to 4,000 roentgens in one or two treatments on successive days. For the larger growths, those over 2 cm. in diameter and of a thickness greater than 5 mm., high voltage x-rays are

A. *B.*

Fig. 9.—Ulcerative infiltrating squamous cell carcinoma of the lip. *A*, Before irradiation; *B*, following 6000 roentgens of high voltage radiation. Free from disease seven years after treatment.

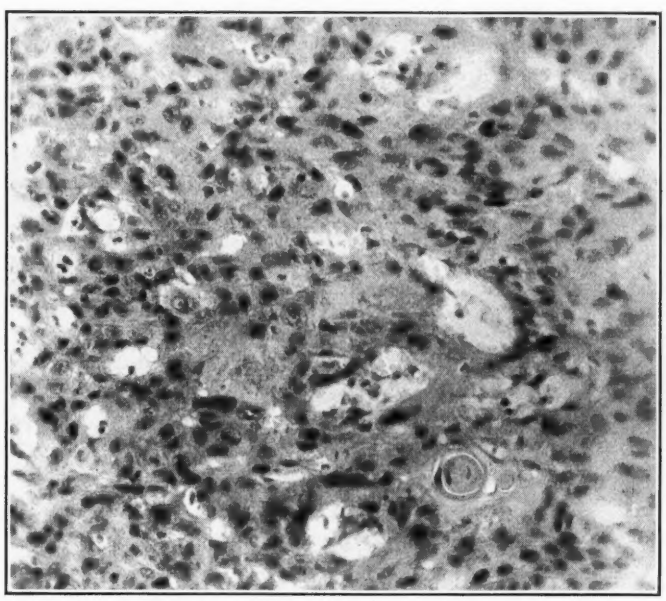

Fig. 10.—Photomicrograph of lesion shown in Fig. 9*A*. Squamous cell carcinoma of the lip, occasional pearl formation, mitotic figures.

used, 200 kilovolts, 4 milliamperes, 10.5 roentgens per minute, lambda effective equaling 0.16, and filtered through 0.5 mm. Cu and 1 mm. Al. In these cases from 4,800 to 8,000 roentgens are given in daily treatments of 200 roentgens each on successive days. This also applies to lesions extending beyond the lip to the floor of the mouth, cheek, or mandible.

If radium is used, radon seeds or platinum needles of 0.5 mm. of platinum filtration are applied, each seed or needle containing 2 millicuries or milligrams of radon or radium element. For the small lesions not over 3 sq. cm., 89 to 90 millicurie or milligram hours of radiation per square centimeter of tissue are given. Thicker lesions should receive higher doses per square centimeter. If the area to be treated is from 5 to 6 square centimeters or more, the dose per square centimeter should be decreased to 70 to 80 millicurie or milligram hours per square centimeter, because of the cross-fire effect of many tubes.

It is always best to err slightly on the side of heavy dosage rather than underdosage. Delayed healing is better than a recurrence. Following this type

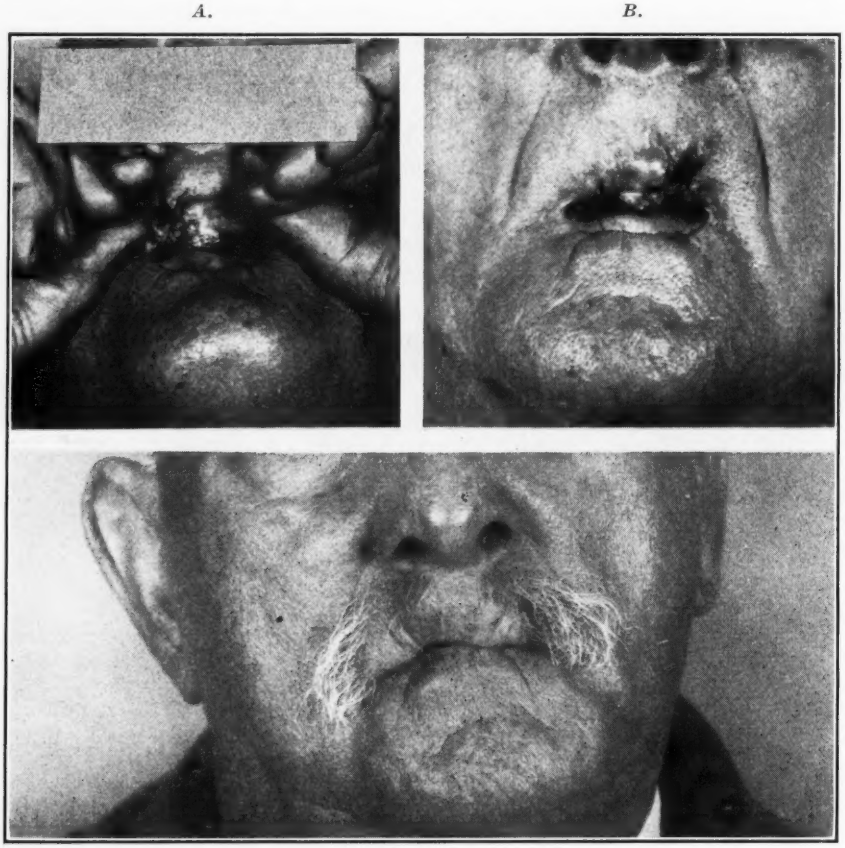

Fig. 11.—Papillary ulcerative infiltrating squamous cell carcinoma of the lip with extension into the mouth. *A* and *B*, before treatment; *C*, following interstitial implantation of platinum removable radon seeds. Patient free from disease seven years after treatment.

of treatment, on the tenth to the fifteenth day there will be evident a reaction on the surface of the tumor, the skin surrounding it, and the mucous membrane of the lip. As a rule, this reaction consists first of an edema of the skin and lip, followed by a destruction of the germinal epithelium of the skin and mucous membrane, leaving a raw surface which will take from ten to twenty days to heal. At this same time the tumor will become much smaller and will usually have disappeared before the skin and mucous membrane have completely healed. This will be from twenty to thirty days following the treatment.

TREATMENT OF CERVICAL METASTASES

In the care of the cervical region of patients with carcinoma of the lip we have maintained a policy of conservatism. All patients with lip and mouth cancer receive roentgen therapy as a preliminary measure. The dose of high voltage radiation is sufficient to produce a bilateral epidermitis with destruction of the germinal epithelium of the skin in from two to three weeks. This reaction usually heals in about fourteen days. Necks presenting no palpable metastatic lymph nodes receive no further treatment. Surgical dissection of the neck when done is unilateral and is as radical as possible. Dissection is limited to fully differentiated epidermoid carcinoma, palpable involvement unilateral, capsule of the node or nodes intact, in patients of good general physical condition in whom the primary growth gives promise of being controlled.

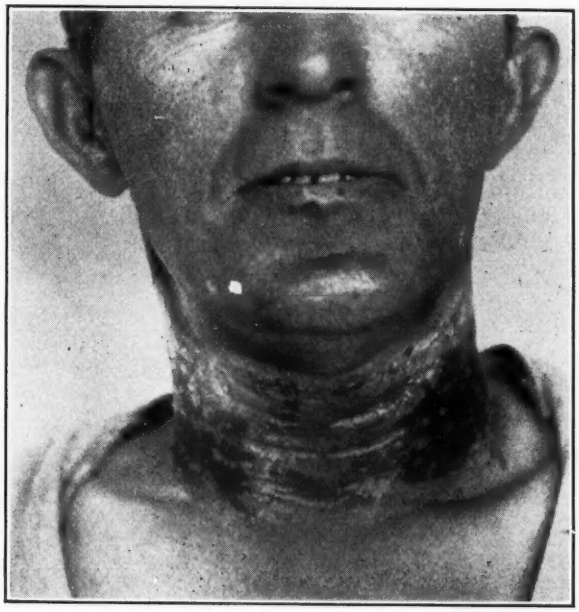

Fig. 12.—Reaction in skin of neck following high voltage irradiation. Typical epidermitis. Regeneration of skin in three weeks. No scarring.

The anaplastic or totally undifferentiated growths are treated by roentgen therapy alone. It is only in the anaplastic or most radiosensitive type of growth that the metastatic node may reasonably be treated by external irradiation alone. Advanced metastatic involvements, particularly when the primary growth is out of hand, and regardless of the histologic type, are left to roentgen irradiation for whatever palliation may be obtained. Under all other circumstances, interstitial irradiation is employed following roentgen therapy.

We, therefore, place narrow limits on neck dissection, and it becomes apparent how diverse are the conditions in which implantation must be employed. Implantation with radon or radium should not be resorted to for short-term palliation. This is a problem for external irradiation. With interstitial irradiation, we should have a "cure" or long-time palliation as our goal. This type of treatment is, therefore, given in all cases in which there is invasion of the node cap-

sule as evidenced by the palpable fixation of the node, in all recurrent cases, and in all cases of bilateral involvement in which the general physical condition of the patient is good. The dose of radon or radium element is governed by the same factors as in the treatment of the primary lesion.

Procedure: The nodes are exposed surgically. It is not possible to make accurate placement of the seeds or needles through skin puncture. Local anesthesia is always preferable to general anesthesia. Care should be taken in the preparation of the skin on account of the previous roentgen irradiation. Tincture of iodine should not be used. Picric acid, 5 per cent in alcohol, is not likely to irritate. Of course, no implantations should be done until the roentgen reaction has disappeared.

The influence of infection cannot be stressed too strongly. In the presence of active infection in the metastatic nodes, irradiation by implantation is at all times contraindicated. The lowering of the vitality of the tumor bed by the irradiation encourages more widespread extension of the infection. The presence of an infected primary growth—even though there is no neck infection—is a contraindication to implantation therapy.

REFERENCES

1. Ewing, James: Neoplastic Diseases, Ed. 3, Philadelphia, W. B. Saunders Co.
2. Martin, H. E., and Ellis, E. B.: Aspiration Biopsy, Surg. Gynec. Obst. **58**: 578, 1934.
3. Martin, H. E., and Quimby, E. H.: Am. J. Roentgenol. **23**: 173, 1930.

JAW FRACTURES*

EDWARD C. ARMBRECHT,† D.D.S., WHEELING, WEST VIRGINIA

A SERIES of 67 patients having jaw fractures is presented, and such salient points as etiology, location, bone involved, type of mouth, type of fracture, length of time before treatment, length of treatment time, methods of treatment used, complications encountered, age, sex and color are discussed. The maxillary and mandibular jaw bones support the soft structures and teeth of the oral cavity, so that when dissolution of these bones occurs other tissues

TABLE I

EXCITING CAUSES OF FRACTURES

Auto accidents	16
Blow	
Fist	18
Iron bar	1
Wood stick	2
Truck chain	1
Bottle	1
Mule kick	1
Cow kick	1
Boxing	2
Baseball bat	1
Coal mine accidents	
Cable	1
Car	1
Pick handle	3
Falling stones	1
Fall	1
Fall from	
Horse	1
Steps	2
Auto truck	1
Wall	2
Miscellaneous	
Baseball	1
Wagon beam	1
Infection	1
Extraction of tooth	4
Unknown	3
Total	67

may be involved besides the bones themselves. Because the body receives its nourishment through the mouth, feeding may become a difficult procedure in some of these cases. Because oral sepsis is a common clinical finding in the average mouth, oral hygiene must be established and maintained throughout the course of treatment, so that infection may be kept at a minimum. Because the mandible transmits a nerve, an artery, and a vein besides being highly vascular throughout its entirety, hemorrhage and pain result quite often; con-

*Read at the West Virginia State Dental Association Meeting at Parkersburg, West Virginia, May 2, 1935.

†From the Oral Service of the Ohio Valley General and Wheeling Hospitals.

sequently immediate immobilization and reduction of the fragments are required. Because many of these patients lack the full complement of teeth, they require more than the proper relationship of those teeth present in order to insure good bone alignment, and such may be added in the form of extraoral appliances. Because of economic conditions, it is essential to have the patient ambulatory as soon as possible; I have found that the plaster of Paris bandage as an additional support, not only gives the patient assurance but also enables him to get back on light duty sooner than if it is not used. Therefore, certain peculiarities must be considered in the treatment of the jaw fracture case, and early treatment seems essential in order to reduce the element of complication and to insure a good functional result.

LOCATION

The fact that the mandible is a third class lever and is attached to the skull in the region of the glenoid fossae of the temporal bone by several pairs

TABLE II

MANDIBLE

Location:				
Coronoid				1
Condyle				32
Ramus				5
Angle				9
Body of mandible, located by teeth:				
Third molar				8
Second molar				4
First molar				12
Second premolar				9
First premolar				6
Canine				8
Lateral incisor				2
Central incisor				1
Symphysis				9
Right 54		Left 43	Total	106

TABLE III

MAXILLA

Location:				
Glabella (nose root)				1
Base of nose				7
Median line				2
Alveolar process				9
Tuberosity				2
Zygoma				5
Malar				2
Right 9		Left 9	Total	28
Remaining 10				

CONDYLE FRACTURES

Extracapsular	R-3	L-2
Intracapsular	R-15	L-12
Unilateral	R-10	L-6
Bilateral	8 × 2	16

BONE INVOLVED

Maxilla	7	Zygoma-malar-maxilla	3
Mandible	50	Maxilla-malar	6
		Mandible-zygoma	1

of ligaments and supported in this position by muscle groups of elevators and depressors, makes it more liable to be injured than the maxilla. The maxilla has no such group of complex muscle attachments which might cause deformity from a muscular pull, as is frequently seen in injuries of the mandible.

Among the bones of the face the mandible is third in frequency of injury, while among the bones of the body it is tenth. The location of these fractures is indicated by the anatomic landmarks of the maxilla and the mandible. Tables II and III show in detail the locations of the fractures in this series of cases.

TYPE OF MOUTH

In the inspection of a jaw fracture case, it is important to note the type of mouth the patient presents because it so often aids in deciding which one or combination of methods for treatment is to be used. It also offers pertinent information regarding the oral health of the patient before his injury. In this series it was found that the case with a full complement of teeth could be handled with dispatch, whereas in cases in which many teeth were missing or in the edentulous mouth more extensive preparation was needed before successful reduction could be accomplished.

TABLE IV

Full complement of teeth		26
Partial number of teeth		36
Edentulous		5
	Total	67

TYPE OF FRACTURE

The number of separate fractures in this series of 67 cases totaled 134. When this number was first found, it was checked and rechecked because it seemed unbelievable that this group of patients actually averaged two separate fractures each. In this tabulation extreme care was taken not to count fractures that were directly associated with one another but only where they existed in distinct separate locations; for example, when a simple fracture was found in the right condyle and another in the left first premolar region, the patient was counted as having two fractures. This analysis seemed to be of extreme interest for several reasons:

1. It proved that a thorough search must be made in all these jaw injuries for more than one fracture.

2. The different types of fractures often require separate appliances for the successful reduction and immobilization of each fracture.

3. The more extensive the injury, the longer the hospitalization period and the greater chance for complications.

4. Predicting any degree of functional disability was not made any easier by this classification.

5. Tabulations were made, first, for the number of fractures and, second, as to the type occurring in each of the patients.

TABLE V

CASES		SIMPLE	COMPOUND	COMPOUND COMMINUTED	COMMINUTED	TOTAL
22	Single	15	21	6	5	47
29	Double	26	24	28	6	84
11	Triple			3		3
4	Quadruple					
1	Quintuple					
67		41	45	37	11	134

LENGTH OF TIME BEFORE TREATMENT

To the best of my knowledge I have never been called in consultation for a jaw fracture injury in which a temporary splint or supportive first aid bandage had been applied. These are recommended in fractures of the limbs,

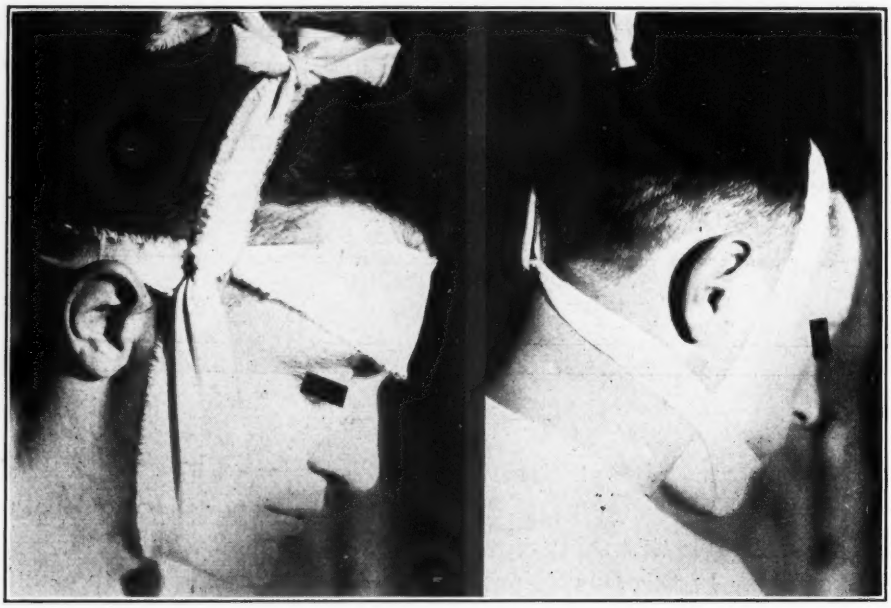

Fig. 1.—Supportive first aid bandages.

and it seems that such a procedure is rational; therefore, their use should be stressed in these cases, especially if the patient has to be transported, so that hemorrhage, pain, and misplacement of the parts will be reduced to a minimum before the radiographs are made and the permanent splints applied. In the

TABLE VI

Shortest	1 hour
Longest	9 months

event that injuries have been too extensive to proceed with the examination and treatment, such first aid measures will also reduce the possibility of swelling and infection, the latter always to be dreaded in any fractured bone. Most of these patients were seen within twelve hours after the injury; those that exceeded this time were usually cases in which nonunion or malunion was present.

LENGTH OF TREATMENT TIME

Inasmuch as this series of cases represented all types ranging from the single-simple fracture to the compound-comminuted fracture, the length of treatment time was variable. Frequently the element of time was increased

TABLE VII

Average	7 weeks
Shortest	2 weeks
Longest	1 year and 2 months

because of complications, the latter depending upon shock, tooth in line of fracture, comminution of the bone, oral sepsis, and mishandling of the parts by the patient himself in an effort to alleviate the pain. In two of these cases

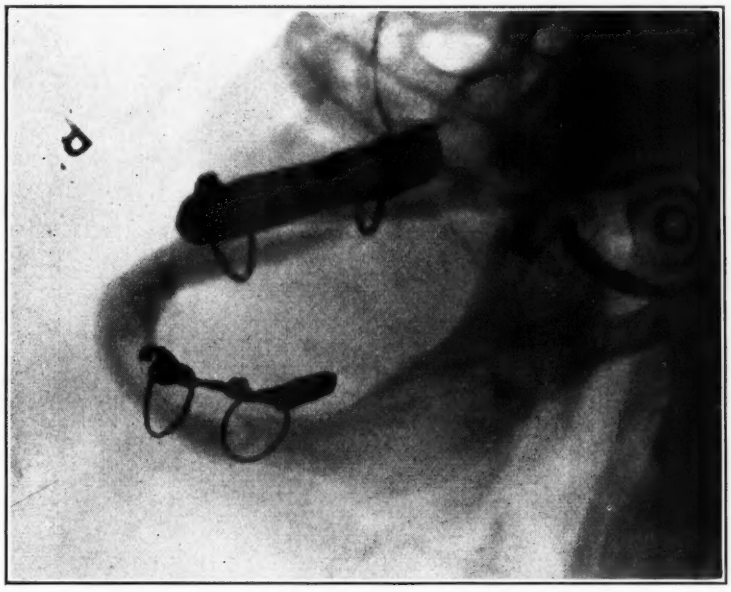

Fig. 2.—Circumferential wiring in edentulous jaw.

in which sequestration of bone took place, my inexperience led me to expect that the callus would bridge the gap, but open reduction was finally required. Given similar cases now, I would feel justified in using the direct method of reduction sooner, thereby reducing the length of treatment time.

METHODS OF TREATMENT

The best guide for the bone alignment is the proper relationship of the maxillary and mandibular teeth and is designated as occlusion of the teeth. Along with the methods available for fixation we must consider such other pertinent points as pain upon movement of the parts, swelling and hemorrhage, deformity and disability, profuse salivation and fetid breath, and finally whether any loose teeth are in situ. If sufficient teeth are present and the location of the fracture permits reduction by means of interdental wires, added support is obtained in the use of the Gluten-gauze bandage or the

plaster of Paris bandage. The edentulous mouths may require extraoral support, circumferential wiring or direct fixation in order to maintain proper reduction and immobilization of the fragments. Oftentimes when there is malposition of the fragments from a muscle pull, some form of elastic traction is required. These methods include many forms of extra- and intraoral fixa-

Fig. 3.—Elastic pull with rubber bands.

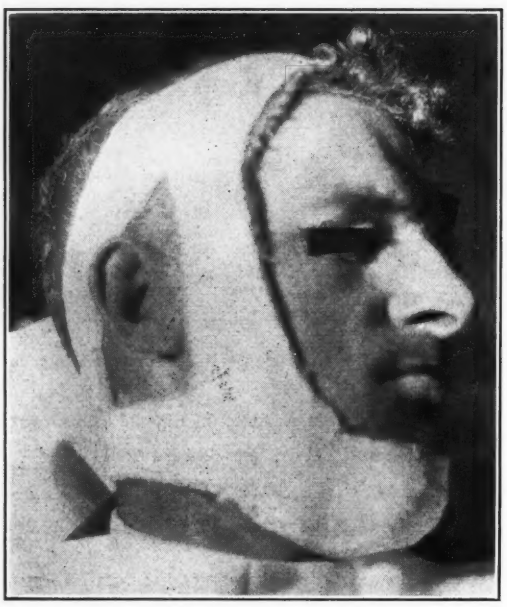

Fig. 4.—Barton bandage with plaster of Paris.

tion appliances, such as several types of bandages, head plaster casts, Kingsley or Hullihen splints, and other fixation methods after Darcissac, Ivy and others.

INFECTION

The application of the various technics can be mastered for the usual run of cases quite easily, but it is the complicated case which often taxes one's

skill to the limit. The most common complication is infection, frequently developing into an osteomyelitis followed by necrosis and loss of bone. Oral sepsis, with its possible predisposition to pneumonia, lung abscess, etc., can be managed by use of certain mouth antiseptic preparations and specific oral hygienic measures. In some patients on whom it was necessary to retain appliances for an unusual length of time, stiffness of the muscles was overcome after the removal of appliances by chewing gum or unvulcanized rubber, or in the use of an exercising device. The use of hot and cold applications in the treatment of swellings about the jaws due to trauma or infection, requires recognition of certain processes resulting from such causes as well as

TABLE VIII

Wires	
Interdental (Gilmer, Ford)	51
Horizontal (after Hammond)	4
Circumferential (after Black)	2
Elastic bands (Moorehead)	6
Splints	
Intraoral	
After Kingsley	9
Cast metal (after Hullihen)	1
Cast metal (after Davenport)	1
Mod. compound	5
Artificial dentures	1
Extraoral	
Head bandage	
Linen (4 tailed)	
Barton and modifications	12
Plaster of Paris	
Barton and modifications	49
Head cap (Darcissac, Ivy, Kazanjian, Blair, Brown)	15
Bed extension frame with pulley and weight (Brown)	1
External incision for drainage	
Open reduction	
Silver wire	2
Green tension suture	5
Extension wire to extraoral splint	5
Kangaroo tendon	1
Bone transplant (tibia)	1
Arthroplasty (temporomandibular joint)	3
Resection of condyle	3
Direct without any appliance	1

the different reactions of heat or cold to the body surface. In general, heat speeds up the blood circulation, whereas cold slows the blood circulation. Various degrees of either are available for use, viz., moist and dry. When normal metabolism of tissue is interfered with by some irritant such as trauma, infection, etc., and function is impaired, it results in an interference with the normal flow of blood and consequently oxidation of the tissues; swelling follows due to hemorrhage and exudation, thereby increasing the tissue tension. This tension blocks the venous and lymphatic flow resulting in intracapillary pressure, elevation of temperature, and pain to the parts. At this stage of the inflammatory process cold applications along with rest are desirable, but afterward, when the metabolic processes are lowered and circulatory sluggishness ensues, I have found that heat, either moist or dry, will enhance the removal of the inflammatory products from the tissues and further influences

either by the abatement of the condition through absorption or in the formation of a localized abscess. Often this condition is aided by gentle massage. Therefore, in conclusion, I might say that cold should be applied in the acute stage; whereas in the succeeding subacute condition, in which nature is making an effort to localize by fibrosis and to evacuate through the liquefaction of the inflammatory products, moist or dry heat is definitely helpful. Cold may be used in the form of cold gauze packs, cold towels or ice-bags; whereas the heat may be used in the form of the infra-red ray, electric light bulbs, hot water bags or by the hot hypertonic wet dressing, which besides rendering a poulticing action keeps the parts soft and pliable, all of which influences the metabolic processes in fighting the infection. The face and neck are closely associated with the jaws; so tissue continuity along with the blood and lymphatic systems must be understood, especially when incisions for dependent drainage

Fig. 5.—Head cast with attached splint for upper jaw.

are planned. Avenues and spaces in which the septic phlegmons are most likely to occur may be designated as: the mandibular, which permits extension backward toward the masseter area, or below into the submaxillary triangle of the neck, or beneath the tongue toward the spaces above or below the geniohyoid muscles, or farther backward to the pharyngeal area, or upward via the masseter into the parotid region. The venous pterygoid plexus drains the alveolar processes and associated parts of the maxilla and the mandible, being also aided by the internal maxillary and facial veins. Any of these venous pathways may be adequate for a septic thrombus. Sudden deaths, in cases in which a persistent cellulitis or extensive stasis is present, may be caused by a septic emboli; or, where severe trauma occurs to the vessels and soft tissues and in the process of healing a propagated thrombus has formed, the thrombus may be dislodged in the act of surgical manipulation, ending its journey in the cavernous sinus.

ANESTHESIA

It is my experience that jaw fracture cases do not do well under a general inhalation anesthetic if the wiring of the mandible to the maxilla is contemplated at the same time. I found that if general inhalation anesthesia was used it was better to leave the placement of the connecting wires until the following day after anesthesia nausea had passed. Embarrassed respiration and swallowing were often encountered from severe misplacement, too tight bandages, or nose injuries. In certain cases the anesthetic of choice was avertin, supplemented by local anesthesia, or in selected cases a short nitrous-oxide-oxygen anesthesia, while the bones were being manipulated in place, permitting the patient to react before the connecting wires were placed. The fact that a patient upon awakening from a general anesthetic finds the jaws

Fig. 6.—Head cast with attached splint for lower jaw.

tightly held together is certainly sufficient reason to frighten him, and this to me seems important enough to be a definite contraindication to the use of a general inhalation anesthetic.

NUTRITION

No time should be wasted in making the patient as comfortable as possible, not only regarding general supportive measures but also in mustering all available methods to give him the necessary nourishment in such concentrated solutions as we may have at hand.

Certain blood tests serve to inform us regarding the patient's reserve and resistance, and this has been found to be of the utmost importance in the treatment of jaw fracture cases. The hemoglobin reading shows the oxygen carrying power in its relation to nutrition of the tissues. While the average

case does not require a sedimentation rate of the blood cells, in many of my cases I used it as a method of determining the general resistance of the patient where chronic infection, in some form, was present. While the Schilling index is used for the acute infections, it may also give a good idea as to the leucocytic response of the body forces to any infection. The nutritive ingredients of carbohydrates, proteins, and fats along with the vitamins, minerals and water, make up the essentials of a well-planned diet. Such essentials as calories and relative amounts of proteins, fats, and carbohydrates were considered of primary importance. For the average workingman in health, 3,000 calories are required, while 2,500 calories are usually sufficient for the woman. With this in mind a diet list was compiled not only to permit a variety but also to insure at least 1,500 calories no matter what the choice might be. It was also found that feedings should be given every two hours in order that sufficient quantity be obtained in the patient's waking day. Often the addition, to the general nutrients of a diet regime, of iron copper, cod liver oil, brewer's yeast tablets, calcium-phosphorus and parathyroid tablets was sufficient to make a favorable difference in the patient's condition as well as progress in his case. Once the general requirement is satisfied, attention must be turned to the calcium-phosphorus intake; and this should include the proper amount, a generous supply, along with ideal conditions for its absorption. Perseverance in the use of calcium therapy in many cases is a factor which brings about successful results contrary to the conflicting reports in the literature favoring a conservative attitude toward its use. Deficiencies vary and do not portray a true picture except in cases wherein it is obvious that a deficiency exists; for example, a striking deficiency may exist in certain pregnancies in which a flow of calcium takes place from the bones and teeth showing extensive dental caries; this flow is controlled by the parathyroids, and if it is of long standing a hyperplasia of this gland becomes evident resulting from its overwork, thus affecting the metabolism due to its influence in the relationship of the various other internal glands. Imbalances may occur even when the blood calcium level gives a normal blood calcium reading. Although the inactive calcium is difficult to estimate, many times certain clinical signs are present which permit its recognition. Thus if depletion of the bones is present, it can only be reinforced by increasing the calcium intake to compensate for this drain, and improvement will ensue provided no permanent imbalance is present in the mechanism of assimilation. The normal content of the daily diet should be 0.7 gm. and 1 to 2 gm. calcium phosphorus respectively, such other approximate quantities as protein 90 gm., and fats 20 gm. It is obvious that milk should be included as the best source of calcium supply, for few other foods contain a sufficient amount unless given in huge quantities, for example, 18 pounds of potatoes, or 10 pounds of butter; while one quart of milk is ample and meets the daily calcium requirement. Addition of the calcium salts in the form of calcium lactate 80 grains or calcium gluconate 160 grains daily, may be necessary. The utilization of calcium depends upon the proper facilities for its absorption. It is soluble in an acid medium and is absorbed through the intestines; absorption is enhanced by the presence of

vitamin D. Some investigators point out that it is insoluble in an alkaline medium or in the presence of excessive amounts of phosphorus; the presence of fat may also prevent its absorption; thus we note certain contraindications. Unquestionably duration of digestion is also a potent factor; for example, it is thought that five to six hours are required for a pint of milk to pass through the stomach while a pint of water takes only approximately forty-five minutes. Milk may be taken with the meals; whereas the calcium salts are best given when the intestinal tract is acid, which period is ordinarily just before mealtime, as the acid condition reaches its height in the fasting period. This acidity is also dependent on the presence of hydrochloric acid furnished by the stomach; hence, since hypoacidity of the stomach is a common finding, it may be necessary to use a dilute solution of hydrochloric acid or fairly large doses of lactose at mealtime to insure the necessary acid environment.

SAMPLE OF JAW FRACTURE DIET (ESTIMATES APPROXIMATE)

TIME	FOOD	VITAMIN	QUANTITY	CALORIES	TOTAL
8 A.M.	Orange juice	A-B-C	1 glass	300	
	Cream of wheat	B	¾ cup	100	
	Cream	A	40 gm.	75	
	Cocoa	D-A	1 cup	300	775
10 A.M.	Cod liver oil	A-D	1 oz.		
	Eggnog	A-B-D	1 glass	200	200
12 M.	Cream celery soup	A-B-D	1 cup	160	
	Boiled custard	A	1 cup	300	
	Purée of carrots	A-B-C	2 carrots	45	
	Pot of tea				505
2 P.M.	Grape fruit juice	A-B-C	1 glass	200	
	White rock water				
	Tomato juice	A-B-C	1 glass	25	
	Cod liver oil	A-D	1 oz.		225
4 P.M.	Cocoa (with brewer's yeast)	A-B-D-G	1 glass	285	285
6 P.M.	Chicken broth	B	1 cup	100	
	Beef ground	A-B	1 tablespoonful	130	
	Purée fresh peaches	C	3 peaches	50	
	Beer or ale	B	1 bottle		
	Mashed potatoes (thinned with milk)	A-B-C	80 gm.	55	335
8 P.M.	Buttermilk	A-B-G	1 glass	90	
	Cocoa	A-D	1 cup	300	390
10 P.M.	Cod liver oil	A-D	1 oz.		
	Orange juice	A-B-C	1 glass	300	300
					3,015

NOTE: Other suggestions are:
Ovaltine
Cocomalt
Vegex
Pablum
Ice cream

BONE REPAIR

Bone repair is a complex process and depends on the general body resistance equation as well as specific factors, such as supply of calcium and phosphorus in the serum, blood dyscrasias, tendencies toward vitamin deficiency as are noted in scurvy, et cetera. Numerous theories have been brought forward, and it is not my intention to enter into a lengthy discussion but rather to state as briefly as possible what occurs under normal conditions. To obtain

normal healing in bone injury we must have the correct chemical state in the blood and the right biologic conditions in the tissues. Certain physiochemical and biologic steps take place which utilize the tissues at hand and replace the fractured bone to its normal contour and function. Usually in a fracture there is bleeding between the bone fragments; the inflammatory exudate caused by the trauma mixes readily with the blood, and a clotted mass results, which is made up of leucocytes and fibroblasts. This mass transforms to what we call granulation tissue, and after five to seven days, vascularization of this tissue mass has taken place and then the connective tissue organizes. Osteoblasts may be derived from the bone cells of the fractured ends or from the fibroblasts being transformed into these osteogenic cells. Such being an end-product and not having the power of multiplying, they concentrate to form the matrix or skeleton frame for the laying down of bone salts later. Once

TABLE IX

AGE

YEARS	
1- 5	1
5-10	2
10-20	10
20-30	20
30-40	14
40-50	9
50-60	7
60-70	4
70-80	0
	67

Youngest	2 yr. 6 mo.
Oldest	64 yr.

COLOR		SEX	
White	61	Male	58
Colored	6	Female	9

this occurs, usually after the tenth to twelfth day, it is called osteoid tissue and is extensive throughout the area of the hard and soft tissues. Canalization by blood vessels through this mass permits the salts (calcium phosphate and calcium carbonate) to be deposited by precipitation when they contact the osteoid matrix. These salts are derived not only from the blood supply but also from the fractured bone ends. Such a process is designated as ossification and not calcification, the latter being the deposition of calcium salts without the previous formation of osteoid tissue as is noted, for instance, in chronic osteitis, etc. Frequently in x-ray studies, after the reduction of a fractured bone, we may note a thinning or resorption at the ends of the fractured bones, which undoubtedly permits new and more extensive trabeculae to be formed at the immediate ends of the bone, thereby enhancing the blood supply for the parts to be healed and thus producing a larger area for the deposition of bone salts. The fibrous tissue formed gives support and aids in the construction of a new blood supply. In those cases in which fibrous tissue is overdeveloped, it destroys the cellular elements and interferes with the formation of this new blood supply so that delayed union results. When

malunion is encountered, it is due directly to insufficient ossification at the bone ends, and this type of case requires bone transplantation grafts. When the normal process continues, however, the deposition of the calcium salts forms a callus which has three distinct parts, namely:

1. External callus, which is the bulky part and is absorbed later.
2. Intermediate callus, which is the direct union.
3. Internal callus, usually the last to be ossified.

The external callus and the internal callus are partially absorbed, while the intermediate callus becomes dense and hard, soon to be the first to represent true bone. The absorption of bony tissue is due to the function of the osteoclasts. Calcium salts and vitamins administered during the period of repair greatly aid in the production of this final callus. The periosteum and the endosteum contribute to a great extent in the formation of new bone, but they also act

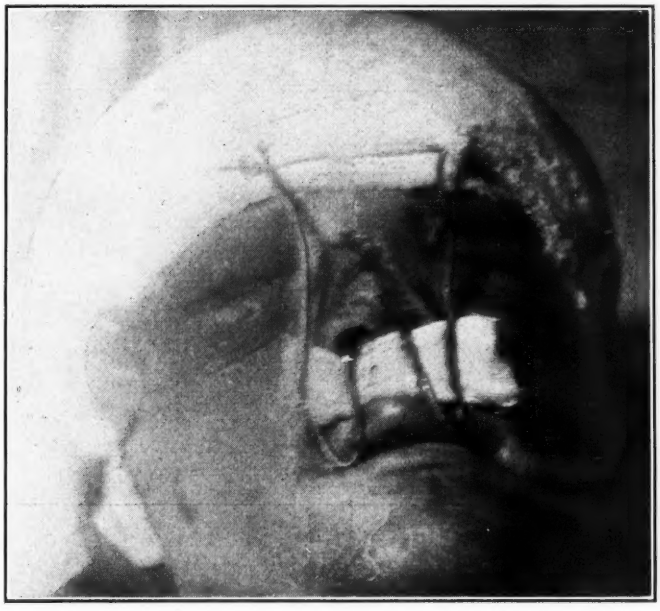

Fig. 7.—Fracture of maxilla, malar, nose and zygoma bones treated with head cast and wires.

as a limiting membrane and in this way mold the contour and shape of the newly formed bone. This brief résumé hardly does justice to the great and complicated subject of bone repair and is only intended to give as clear a description as I have been able to glean from the literature at hand, presenting it in as simple a manner as possible.

DISABILITY

If the principle of establishing and maintaining the proper occlusion of the teeth as a guide in the reduction of the jaw fracture is kept in mind, then less partial and complete disability results. The small fractured condyle usually unites or is absorbed and never impairs the joint function. Recognition of such factors which cause infection along with the employment of early external incisions will invariably prevent abscess formation of the surrounding

tissues and subsequent bone involvement. Cases with extensive loss of bone, malposed condylar fractures, and malunion of the fragments ordinarily end with a marked functional disability; for example, the large condyle fracture, which has ruptured through the capsule and is pulled out of the glenoid fossa. Seldom are these cases treated successfully by the closed method, but they do react kindly to the open method. However, temptation to try direct wiring, plating, or the use of grafts should be resisted until swelling of the soft tissues subsides, oral communication with the fractured area has healed over, and the normal oral environment returns. Ankylosis of the temporomandibular joint is rare but may follow the acutely inflamed malposed condylar fracture if not put at rest, more especially if opposition to an adjacent bony surface occurs permitting union, for example, the zygomatic process of the temporal bone. Once this is present, it may be necessary to do an osteotomy or resection

TABLE X

COMPLICATIONS

Cyst (dentigerous)	1
Infection	
Bone	15
Maxillary sinus	6
Septic phlegmon	6
Vincent's stomatitis	5
Malunited fracture	5
Nonunion of fractured bones	8
Hemorrhage	3
Loose deciduous teeth	3
Small mandible due to shrinkage of bone following removal of teeth	5
Alcoholism	4
Tongue injury	2
Ankylosis	
False—trismus	2
True—temporomandibular joint	3

and arthroplasty in order to relieve the disability. Faulty repositioning of the condyle, occlusal imbalances of teeth, weakened muscle or ligament support, all create abnormal pressure on the joint and adjoining tissues to the extent wherein patients frequently claim disability. These complaints include impaired hearing, noises and pain in and about the ears, dizziness from intratympanic pressure, neuralgic headache, burning sensations in the nose, throat, tongue and mouth; all are improved greatly by relieving this pressure.

In some of the more complicated cases in which comminution of the bones results, the patient might complain of a numbness in the lip or cheek; and in injuries closely associated with the eyes, disturbance of vision due to the severing of the optic nerve or to a detachment of the retina is possible. Unless the fragments are replaced to their normal position, permanent disability will remain; otherwise the nerve tissue heals in, and these symptoms gradually disappear. The length of time depends upon the extent of the nerve injury. In those patients who complain of loss of sensation in the peripheral nerves, we must consider deep sensibility and superficial sensibility impulses being

interfered with and not necessarily direct injury to the main nerve trunk. While the deep sensibility has to do with the muscles, ligaments, periosteum, and joints, the superficial or cutaneous sensibility involves the sensory nerves from the end-organs in the skin and may be divided into the protopathic and epicritic. The former is thought to return in ten to thirty weeks and depends upon regeneration to certain areas, while the latter deals with a more sen-

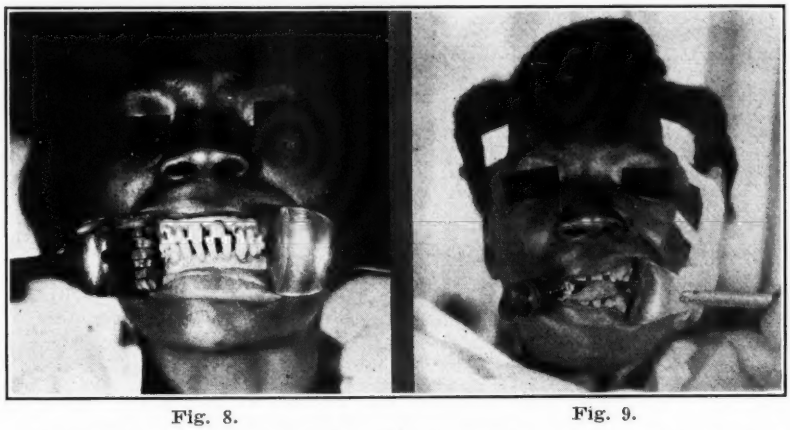

Fig. 8. Fig. 9.

Fig. 8.—Unilateral bony ankylosis of temporomandibular joint (thirteen years' duration).
Fig. 9.—Joint function restored by arthroplasty.

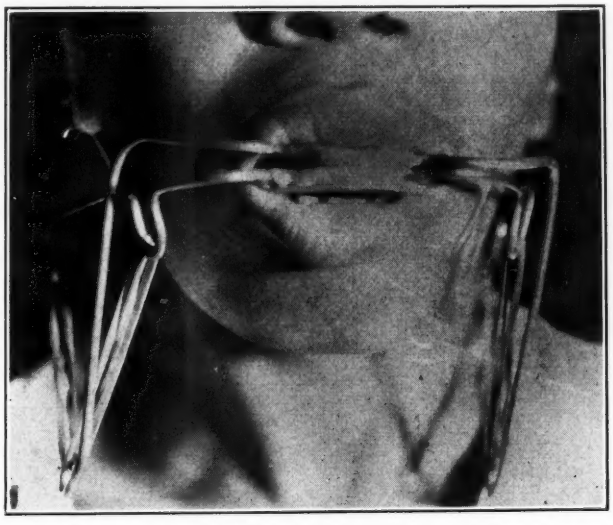

Fig. 10.—Use of exercising device in postoperative treatment (after Ivy).

sitive group, and in the case of a long nerve injury, recovery may be delayed one to two years. In order to ascertain the degree of insensibility to these tissues such discriminating methods, in the form of a compass point, cotton applicator, or pencil passing over the area, may be used. In some instances in which the injury has been very extensive a spine involvement may be encountered, and because of this possibility it seems wise to consider radiographic examination of the entire spinal column in such cases.

EXERCISING DEVICES

Practically all patients who were treated for fractures involving the angle, ramus, coronoid, and condyle suffered from various degrees of trismus after the retentive appliances were removed. Ordinarily this stiffness of the muscles was overcome in a short period by the normal movements of mastication. In a few cases, however, because of the lengthy time appliances were in situ or to a fracture which had involved the elevators or depressors of the man-

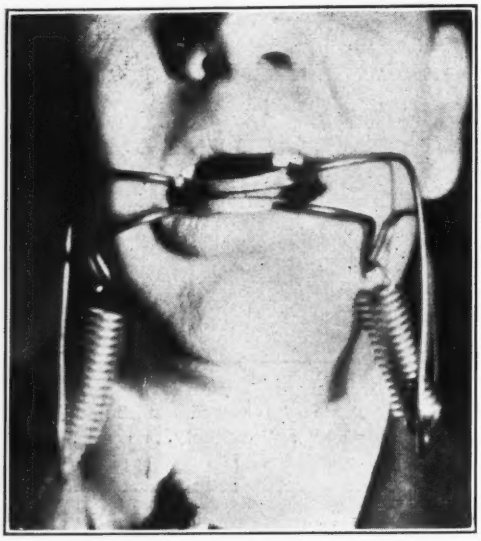

Fig. 11.—Mastication pressure device for measuring disability of fractured jaw cases (after Ivy, except torsion springs substituted for rubber bands).

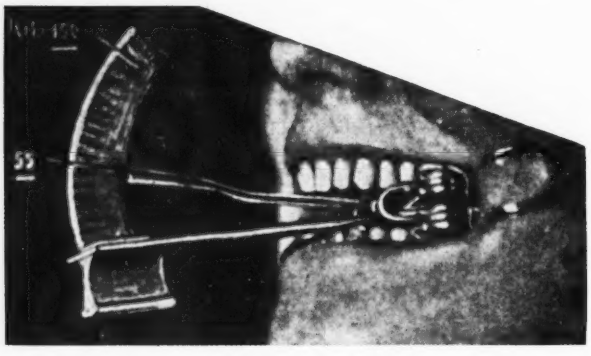

Fig. 12.—Mastication pressure meter designed by Gustav Haber, Berlin, Germany.

dibular musculature creating some atrophy to them, it was found helpful if the exercising device was used. The principle of this device was first used by Darcissac but was modified by Ivy, and in two of these cases torsion springs were substituted for the rubber elastic bands because greater dilating force was required than could be had from the rubber bands. One of these patients with apparatus in place is shown by Fig. 10; it was applied two times each day for a period of one-half hour each. If modelling compound is used in the trays, a better grip is possible for the patient, making the counteraction treatments more effective. Massage of the muscles and the use of infrared radia-

tion once each day also helped. Muscle balance returned in from one to four weeks after the fixation appliances had been removed. The gnatho-dynamometer designed by Gustav Haber of Berlin is used to determine the masticatory power pressure of the teeth. With the addition of larger trays it seems to be a practical means of measuring jaw pressure after these injuries and possibly determines the percentage of their disability especially in those cases in which it is an issue.

SUMMARY

Sixty-seven jaw fracture cases are reported in this series, representing a total of 134 separate fractures.

The fist and the automobile were found to be the most common causes (Table I).

The condyle was the most common site of fracture (Table II).

Fig. 13.—Author's contrivance when temporary jaw support is required; made of silk helmet and muslin chin cup.

The mandible was involved in fifty of these cases (Table III).

There were only five of these patients with edentulous mouths; the remaining had teeth in situ (Table IV).

The double compound comminuted type of fracture was most common (Table V).

The shortest time to elapse before treatment was two hours, while the shortest length of treatment time was three weeks (Tables VI and VII).

Methods of treatment embrace varieties of intra- and extraoral appliances (Table VIII).

The greatest number of fractures occurred between the ages of twenty and thirty years (Table IX).

The youngest patient was two years six months, while the oldest was sixty-four years old (Table IX).

Relative to color and sex there were 61 whites, 6 colored; 58 males, 9 females in this series (Table IX).

The most common complication was infection (Table X).

COMMENT

This paper is the result of observations made during the past ten years in the treatment of jaw fracture cases. In writing it an effort was made not only to include statistics of the cases handled, but also to discuss such pertinent points as were thought to be valuable and interesting to the reader. Although the condylar area was the most common site of fracture, reports in the literature concerning it varied from 2 per cent to 50 per cent as to frequency of fracture. Possibly this variation can be explained because of an inadequate radiographic technic to portray clearly the temporomandibular articulation, or in some cases lack of the patient's cooperation because of the particular type of these injuries; on the other hand, an ideal standard radiographic technic appears inapplicable in all cases and varies with the ability of the patient to cooperate. Finally it is obvious that a complete radiographic examination is essential to ascertain the exact number of separate fractures in all these cases.

REFERENCES

1. Armbrecht, Edward C.: The Importance of Oral Hygiene in the Hospital, West Virginia M. J. **29**: February, 1933.
2. Bernheim, Alice B.: Calcium in Nutrition, The Health Examiner **4**: December, 1934.
3. Blair, V. P.: Intra-Oral Support of the Ramus in Fractures of the Lower Jaw, Dental Cosmos, June, 1923.
4. Bodine, R. L.: Int. J. Orth. **14**: 998, 1928; **15**: 163, 1929.
5. Brooke, R.: Wire Extension in Treatment of Mandibular Fractures, Brit. M. J. **2**: 498, 1935.
6. Darcissac, Marcel: Contribution à la Prothese Chirurgicale de l'Etage Moyen de la Face, Paris, 1925.
7. Darcissac, M.: Dental Churs. **64**: 356, 1922.
8. Dechaume, M., and Vachey, A.: The Septic Phlegmon of the Floor of the Mouth, Int. J. Orth. **16**: August, 1930.
9. Dorrance, Geo.: Fractures, Clinics of North America, February, 1935.
10. Gill, A. Bruce: Heat in Surgical and Orthopedic Conditions, J. A. M. A. **106**: Jan. 4, 1936.
11. Gilles, H. D., Kilner, T. P., and Stone, D.: Brit. J. Surg. pp. 14-651, 1927.
12. Grossman, Harry D.: Removal of Plaster of Paris Casts, Am. J. Surg. **27**: 267, 1935.
13. Hanson, Joseph A.: Facial Fractures: Methods of Treatment in the General Practice, Dental Survey, December, 1935.
14. Hullihen, S. P.: Abscess of the Jaws and Its Treatment, Am. J. D. Sc. Vol. VII; 1st series, 1846-47; pp. 138-151.
15. Ivy, Robt. H., and Curtis, Lawrence: Further Observations on Fractures of the Mandible, Dental Cosmos, April, 1929.
16. Ivy, Robt. H., and Curtis, Lawrence: Complicated Fractures of the Mandible, S. Clin. North America, December, 1930.
17. Ivy, R. H.: J. A. M. A. **75**: 1316, 1920.
18. Ivy, R. H.: J. A. M. A. **79**: 295, 1922.
19. Ivy, Robt. H.: Fractures of the Jaws, Surg. Gynec. Obst. February, 1935.
20. Kazanjian, V. H.:: Dental Prosthesis in Relation to Facial Reparative Surgery, Surg. Gynec. Obst. **59**: 70, 1934.
21. Kazanjian, V. H.: Traumatism of the Face and Jaws With Special Reference to Complications, J. A. D. A. **21**: 1138, 1934.
22. Kazanjian, V. H.: Injuries to the Face and Jaws Resulting From Automobile Accidents, Tr. Am. Acad. Ophthal. & Otol. 1933.
23. Lyons, Chalmers J.: Some Vital Phases of Fractures of the Jaws, J. A. M. A. **71**: 164, 1918.
24. Madarasz, E. von: The Treatment of Fractures of the Jaw, Ztschr. f. Stomatol. **33**: 838, 1935.

25. McCollum, E. V.: Where We Stand Now in Our Knowledge of Nutrition, Medical Searchlight and Science Bull. **8**: January, 1932.
26. Moorhead, Frederick: A Better Method of Treating Fractures of the Jaws, J. A. M. A. May, 1934.
27. Oliver, Robert: J. A. M. A. **54**: 1187, 1910.
28. Popdolin, Matthew: Differential Diagnosis of Inflammations Confronting the Dentist, J. A. D. A. **22**: 1694, 1935.
29. Preston, John L.: Methods of Treating Mandibular Fractures by the Application of Specially Designed Appliances, INT. J. ORTH. July, 1931.
30. Reichenbach, Erwin: Die Verrenkungsbruche des Unterkiefergelenkkopfs, München.
31. Risdon, F.: J. A. M. A. **79**: 297, 1922.
32. Schaeffer, J. E., and Skinner, M. B.: The Therapy of Jaw Fractures and of Face Injuries; The Therapeutics of the Cook County Hospital, edited by Bernard Fantus, M.D., Chicago, November, 1935.
33. Scogin, C. W.: INT. J. ORTH. **14**: 526, 1928; **16**: 996, 1930.
34. Silverman, S. L.: A New Operation for Displaced Fractures at the Neck of the Mandibular Condyl, Dental Cosmos **67**: 876, 1925.
35. Taylor, Frederic W.: The Hypertonic Wet Dressing, An Experimental Study, Surg. Gynec. Obst. **61**: 623-628, 1935.
36. Sprawson, Evelyn: "Spontaneous" Fracture of the Mandible Following Dental Extraction, Brit. D. J. **58**: 555, June 1, 1935.
37. Straith, Claire L., and Straith, Floyd E.: Facial Bone Injuries, Dental Digest, October, 1933.
38. Weisingreen, H. H., and Levin, W. N.: Fractures of the Jaw and Allied Traumatic Lesions of the Facial Structure, Ann. Surg., 1935.
39. Winter, Leo: Fractures of the Mandible (Study of 200 Cases), Dental Cosmos **76**: 316, 1934.
40. Bainbridge, William S.: Report on Sixth International Congress of Military Medicine and Pharmacy, The Hague, The Netherlands, U. S. Naval Reserve, George Banta Publishing Co., Wisconsin, 1931.
41. Berger, Adolph: The Principles and Technique of Oral Surgery, New York, N. Y., 1927, Claudius Ash, Sons & Co., Chapter XIX.
42. Blair, Vilray Papin: Surgery Diseases of the Mouth and Jaws, St. Louis, Mo., 1920, The C. V. Mosby Co., Chapters VI, VII, VIII, IX.
43. Boyd, William: Surgical Pathology, Winnipeg, Canada, 1933, W. B. Saunders Co., p. 689.
44. Cowdry, Edmund V.: Special Cytology, New York, 1930, Paul B. Hoeber, Vol. II.
45. Cryer, M. H.: The Internal Anatomy of the Face, Philadelphia and New York, 1916, Lea & Febiger, p. 61.
46. Gilles, H. D.: Plastic Surgery of the Face, London, 1920, H. Frowde.
47. Gilmer, T. L.: Lectures on Oral Surgery, Chicago, 1901.
48. Gray, Rosco: Attorney's Textbook of Medicine, Hartford, Conn., 1934, p. 489.
49. Hanke, Milton T.: Diet and Dental Health, Chicago, 1933, University of Chicago Press. (Chapter VI.)
50. Ivy, Robert H.: Applied Anatomy and Oral Surgery, Philadelphia, 1920, W. B. Saunders Co. (Chapter III.)
51. MacNevin, Malcolm, and Vaughn, Harold: Mouth Infections and Their Relation to Systemic Diseases, New York, 1933, Joseph Purcell Research Memorial. (Chapter V.)
52. McCollum, E. V., and Simmonds, Nina: The Newer Knowledge of Nutrition, New York, 1927, The Macmillan Co. (p. 429).
53. Osgood, Herman A.: Teeth and Jaws, New York, 1929, Paul B. Hoeber, Inc. (Plate LV.)
54. Prinz, Hermann: Dental Formulary, Philadelphia, 1923, Lea & Febiger. (Chapter VI.)
55. Slosson, Edwin E.: Creative Chemistry, New York, 1919, Century Company. (Chapter VI.)
56. Smith, David T.: Oral Spirochetes and Related Organisms in Fuso-Spirochetal Disease, Baltimore, 1932, Williams & Wilkins Co. (Chapters XII and XXI.)
57. Thoma, Kurt: Clinical Pathology of the Jaws, Springfield, Ill., 1934, Charles C. Thomas. (Chapter III.)
58. Zemsky, James L.: New Conservative Treatment vs. Surgical Operation for Displaced Fractures at the Neck of the Mandibular Condyl, Dental Cosmos, p. 43, 1926.

77 TWELFTH STREET.

Department of Orthodontic Abstracts and Reviews

Edited by
Dr. Egon Neustadt, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. Egon Neustadt, 133 East Fifty-Eighth Street, New York City.

Your Breath and Your Health. By Louis M. Pearlman, 1936, New York, Academy Publishing Co.

"A bad odor is a warning of bad activities!" Since the exhaled breath comes from the sum total of the body's metabolism, it is bound to furnish evidence of the chemical and physical processes which go on within the body. Offensive breath is, therefore, a warning (to be detected chiefly not by the carriers themselves, but by others).

GENERAL CONSIDERATIONS

Exhaled air contains 4 per cent more carbon dioxide, 5 per cent less oxygen than inhaled air, and is always of body temperature. Combustion of oxygen within the body takes place slowly; but, if it were possible to concentrate the combustion processes, a continuous flame, larger than that of a burning candle, would result. Breath also takes an important part in regulating body temperature, through evaporation of water from the inner surfaces of the lungs (which is 100 times larger than the skin surface). The combustion gases in the exhaled breath are principally carbon dioxide and water vapor and should be colorless and odorless. Similar to the "flue test" by which the efficiency of the furnace combustion is determined, the metabolism test determines the amount of oxygen consumed and of carbon dioxide eliminated (rate of metabolism).

The intimate relation of the breath to the blood may be demonstrated by the travel of one isolated red blood corpuscle, named Busybee. It leaves the heart bright red in color through the aorta; it enters an artery leading, for instance, to the intestines and finally a capillary. There it exchanges, through delicately thin capillary walls, its load of oxygen for a load of carbon dioxide from the tissues. At the same time, the blood plasma gives nutriment to the tissues in exchange for chemical waste products. Busybee's color has now changed to blue, and it enters the venous circulation. In our particular instance, Busybee returns to the heart only by a detour through the liver (portal vein), where most toxic and odorous substances from the intestines are detoxicated and deodorized. After its return to the heart Busybee starts on its pulmonary circulation: It enters the pulmonary artery and eventually one of the pulmonary capillaries which form a network around the alveoli of the lung (their total surface would cover 2,000 square feet). Here Busybee turns red again, after giving off its load of carbon dioxide while the blood plasma gives off vapor and traces of other

waste products. Then it reenters the heart. Every hour 100 gallons of air come in contact with the same quantity of blood (circulating through the body at the rate of three or four miles a day).

LOCAL CAUSES

Local causes of bad breath are unhealthy conditions of the air passages, nose, throat, lungs, mouth. Their importance lies in the fact that they may become a source of systemic infections. (1) Focal infection (teeth, tonsils, etc.) in the mouth may contribute to bad breath in two ways: directly through imparting bad odor by direct contact with the exhaled air, or indirectly through the absorption of toxins into the venous capillaries and their final elimination as waste substances into the air of the lungs. (2) Garlic and onion odors are solely due to the adhering of their essential oils to the surfaces within the mouth; even large amounts of these oils swallowed in capsules produce no odor in the breath. The best way to overcome these odors is by washing the mouth with a paste containing soap and then rinsing with preparations of chlorine which chemically destroys the obnoxious oils. (3) Infections of the mouth are caused by germs which frequently hide in the mucous membrane of gums, tongue, and about the teeth, thriving in the presence of warmth, moisture, and food. These germs become virulent only when a lowering of resistance to infection occurs. Under normal conditions, nature's own mouth wash protects against them; namely, the flow of one to two pints of saliva per day, and the swallowing of it into the stomach where the germs are destroyed by the gastric juices. Artificial mouth washes can only act in a similar manner by flushing away the germs, because it is impossible to sterilize the mouth. A germicide strong enough to kill microbes would also destroy the soft tissues; mild antiseptic solutions, on the other hand, do not remain in the mouth long enough to be effective. (4) Teeth are a frequent cause of offensive breath, through active decay, through ill fitting dental restorations, and through pyorrhea. (5) The coated tongue contains in the furred coating a large variety of microorganisms, decayed food particles, and dead cells. Sometimes persons in perfect health have a coated tongue on account of a high arched palate which prevents normal functioning of the tongue, or on account of the loss of many teeth. Most commonly, however, the coated tongue accompanies a sluggish gastrointestinal tract. (6) The tonsils with their deep crypts present an ideal hiding place for bacteria discharged from mouth or throat, and they are more often the sources of bad breath than is generally realized. (7) The nose contributes several local causes: foreign bodies in the nose; nasal obstructions which interfere with normal air circulation; ozena, a disease characterized by sloughing of the tissues and foul breath; chronic dry nasal catarrh; sinusitis. (8) The common cold (coryza) which really consists of two stages: the early stage, caused by the filterable cold virus, which produces rather mild symptoms of sneezing and watery discharge; this is soon followed by a secondary infection from bacteria like the influenza bacillus, streptococcus, pneumococcus, etc. The discharge becomes thick and purulent, and the body temperature rises. Sequels of the common cold are ear and mastoid infections which influence the breath either directly through the eustachian tube or indirectly through absorption of infectious matter into the blood stream.

SYSTEMIC CAUSES

Systemic causes may originate in any organ; the odorous substances reach the breath by way of the blood circulation through the lungs. (1) Foods and drugs (ether, alcohol, tobacco) are mostly passed out of the body by other eliminators (kidneys, bowels), but a small portion of them is eliminated by the breath. (2) Faulty elimination by kidneys, bowels, or skin, throws an extra amount of waste products upon the lungs for elimination; in severe kidney diseases, for instance, the elimination of urine is so hampered that the breath acquires a urinous odor. In cases of prolonged constipation the blood may absorb traces of the contents of the bowel (such as the ill-smelling hydrogen sulphite gas), and carry it through the circulation to the breath. (The largest part of absorbed bowel contents, however, is deodorized and detoxicated by the liver.) (3) Abnormal metabolism. The "bad" stomach has received most of the blame for offensive breath unjustly, because its cardiac sphincter prevents gases from the stomach from escaping into the breath (except in belching). For this reason, toxins of the stomach can reach the breath only through the medium of the blood stream. In severe conditions of diabetes, acetone is eliminated through the lungs. Cirrhosis of the liver which interferes with its function as a buffer against toxins (assimilated from the gastrointestinal tract) gives rise to foul breath. Infections and inflammations are responsible for the creation of ill-smelling pus, which sometimes is an actual aid in diagnosis (garlic odor of diphtheria, mousy odor of typhoid and syphilis). (4) Certain emotional and mental states may influence the breath by upsetting the normal metabolism and disturbing the organs of elimination (cold sweat, loose bowels, excess of urine, rapid breathing).

E. N.

International Journal of Orthodontia and Oral Surgery

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 3523-25 Pine Blvd., St. Louis, Mo.

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 75 cents. To any place in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $7.00 per year in advance. Under foreign postage, $7.40. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, post office or express money order, payable to the publishers, The C. V. Mosby Company.

Contributions.—The editor will consider for publication original communications of merit on orthodontic and allied subjects, which must be contributed solely to this Journal. Original, double spaced, typewritten copy should be submitted.

Opinions—Neither the editor nor the publisher holds himself responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—The publishers will communicate with authors regarding reprints upon publication of papers.

Communications—Contributed articles, illustrations, letters, and all other matter pertaining to the editorial department should be addressed to the editor, Dr. H. C. Pollock, 4482 Washington Blvd., St. Louis, Mo. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 3523-25 Pine Blvd., St. Louis, Mo.

Illustrations—Such half-tones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

Advertisements — Objectionable advertisements will not be accepted for publication in this Journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

Change of Address—The publishers should be advised of change of subscriber's address about fifteen days before date of issue with both new and old addresses given.

Nonreceipt of Copies—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply may be exhausted.

Entered at the Post Office at St. Louis, Mo., as Second Class Matter

Editorial

Dental Education

AS pointed out in the Presidential Address delivered before the American Dental Association in San Francisco this last summer, dentistry has rapidly been asserting itself and demanding recognition as a true science. Dentistry is rapidly emerging from its former status, and perhaps more progress has been made recently than during its entire previous period of development. Dentistry is now classed as one of the important divisions of the healing art, and many mileposts are being passed which indicate change for the better.

Medicine many years ago experienced a similar period of evolution. Medical education, it is recalled, underwent an extensive housecleaning in America. Colleges were closed and entrance requirements were raised and honestly en-

forced. Hospitals also shared the attention; they were finally inspected and classified; and now honest medicine is being taught, and for the most part excellent service is being rendered. The result is that the teaching of medicine and the practice of medicine in America are now a glory to which the medical profession may point with pride.

Another step in medical history occurred when the American Medical Association took up the work of exposing manufacturers who had waxed fat from blood money wrung from the hosts of those who were sick in body and in mind by selling to them preparations with no more curative value than discolored tap water. Today most of these have been "driven from the temple."

Dental education is attracting greater attention. Soviet Russia has formulated plans in the medical sciences for hundreds of thousands of Russians. Measures have been outlined to increase the number and to improve the training of physicians, nurses, dentists, and even druggists. The plan provides for the establishment of many new schools, including junior medical schools with three-year courses and an enrollment of 447,700 students. To this will be added medical laboratory courses for technicians and the establishment of dental schools in which students will be required to study from four to seven years.

The American Dental Association, realizing fully the opportunity which has presented for the advancement of the profession, proposes to investigate dental education and exert its influence in guiding and directing the course of dental training of the future. The American Dental Association's Educational Committee of seven, three of whom are in no way connected with dental education institutions, has a job outlined for it.

The rank and file of the dental profession have awakened to evaluate dental schools not by the yardstick of gusto and scientific swashbuckling, not by the clinics ostensibly operated for the indigent but which in many instances are profitable business institutions, but by the type and quality of teaching being done, the quality of the faculty, and the quality of the student body being taught. The theme song of science and the scientific mode of thought in dental instruction are now taken with a grain of salt, unless the type of instruction given to dental students and the clinical policies of schools square with the scientific build-up so generously broadcast.

Soviet Russia obviously believes it to be to the benefit of its citizens that professional education be handled by the state. The American Dental Association plainly believes that there are many defects in American dental education but that these defects can and will be corrected in the near future.

H. C. P.

News and Notes

American Society of Orthodontists

The date of the thirty-fifth annual meeting of the American Society of Orthodontists to be held at the Edgewater Beach Hotel, Chicago, has been changed from April 26-29, 1937, as was announced in the last issue of the Journal, to April 19-22, 1937.

PAUL G. SPENCER, President,
1817 Austin Avenue,
Waco, Texas.

CLAUDE R. WOOD, Secretary,
608 Medical Arts Bldg.,
Knoxville, Tenn.

Southern Society of Orthodontists

The fifteenth annual meeting of the Southern Society of Orthodontists will be held at the Atlanta Biltmore Hotel, Atlanta, Ga., on January 25, 26, and 27, 1937. All ethical members of the dental and medical professions are cordially invited.

WILLIAM A. CLARK, President,
Medical Arts Bldg.,
Atlanta, Ga.

WILLIAM P. WOOD, JR., Secretary,
442 West Lafayette Street,
Tampa, Fla.

Marquette University Dental Alumni Association

The thirtieth annual meeting and clinic of the Marquette University Dental Alumni Association will be held October 21-24, in Milwaukee.

H. E. THIELE, Secretary,
447 N. 27th Street,
Milwaukee, Wis.

Great Lakes Association of Orthodontists

The tenth annual meeting of the Great Lakes Association of Orthodontists will be held at the Royal York Hotel, Toronto, Canada, on Monday and Tuesday, October 19 and 20. An excellent program of papers, clinics, and entertainment has been arranged.

G. VERNON FISK, President.

S. STUART CROUCH, Secretary,
86 Bloor Street, W.
Toronto, Canada.

Mexican Orthodontia Association

The Mexican Orthodontia Association, established in the capital of the republic, will receive with great pleasure the visit of any orthodontist who may be in Mexico as a tourist.

The society has had the honor of receiving several orthodontists from the United States: Dr. Brooks Bell, of Dallas, introduced into Mexico the chrome alloy and its manipulation; Dr. John Taylor, of Hollywood, discoursed on the problems of orthodontia. In February the society was honored by a visit from Dr. Spencer R. Atkinson, of Pasadena, Calif., who conducted a brilliant conference on orthodontia, the practical results of which greatly benefited the members and stimulated the study and progress of orthodontia in Mexico.

Dr. Samuel Fastlicht, Secretary,
Madero 40,
Mexico, D. F.

New York Society of Dental History and Culture

For those interested in the history of the profession and its cultural background, the Society will offer for its first meeting of the 1936-1937 season, on Thursday evening, October 15, "An Evening With John Hunter: A Symposium of Papers Relating to the Various Hunterian Activities in Dentistry."

The meeting will be held in the auditorium of the Squibb Building, 58th Street and Fifth Avenue, New York City, at 8:15 P.M.

An interesting exhibit of the works of John Hunter, photographs, and other data relating to his activities in dentistry will be held at the New York Academy of Medicine October 5-15.

All persons affiliated with the profession and their friends are welcome to the meetings of the society.

Walter H. Jacobs, Secretary,
124 West 93rd Street,
New York, N. Y.

Notes of Interest

Dr. A. R. Abrams announces the opening of his office at 403 Medical Arts Bldg., Philadelphia. Practice limited to orthodontia.

Dr. J. Ben Goldsmith announces the removal of his offices to 8 West 40th Street, New York City, and to 135 Central Ave., Lawrence, N. Y. Orthodontia exclusively.

Dr. John Sage announces the removal of his office to the Warren Apartments, 133 Sanford Ave., Flushing, L. I., N. Y. Practice limited to orthodontia.